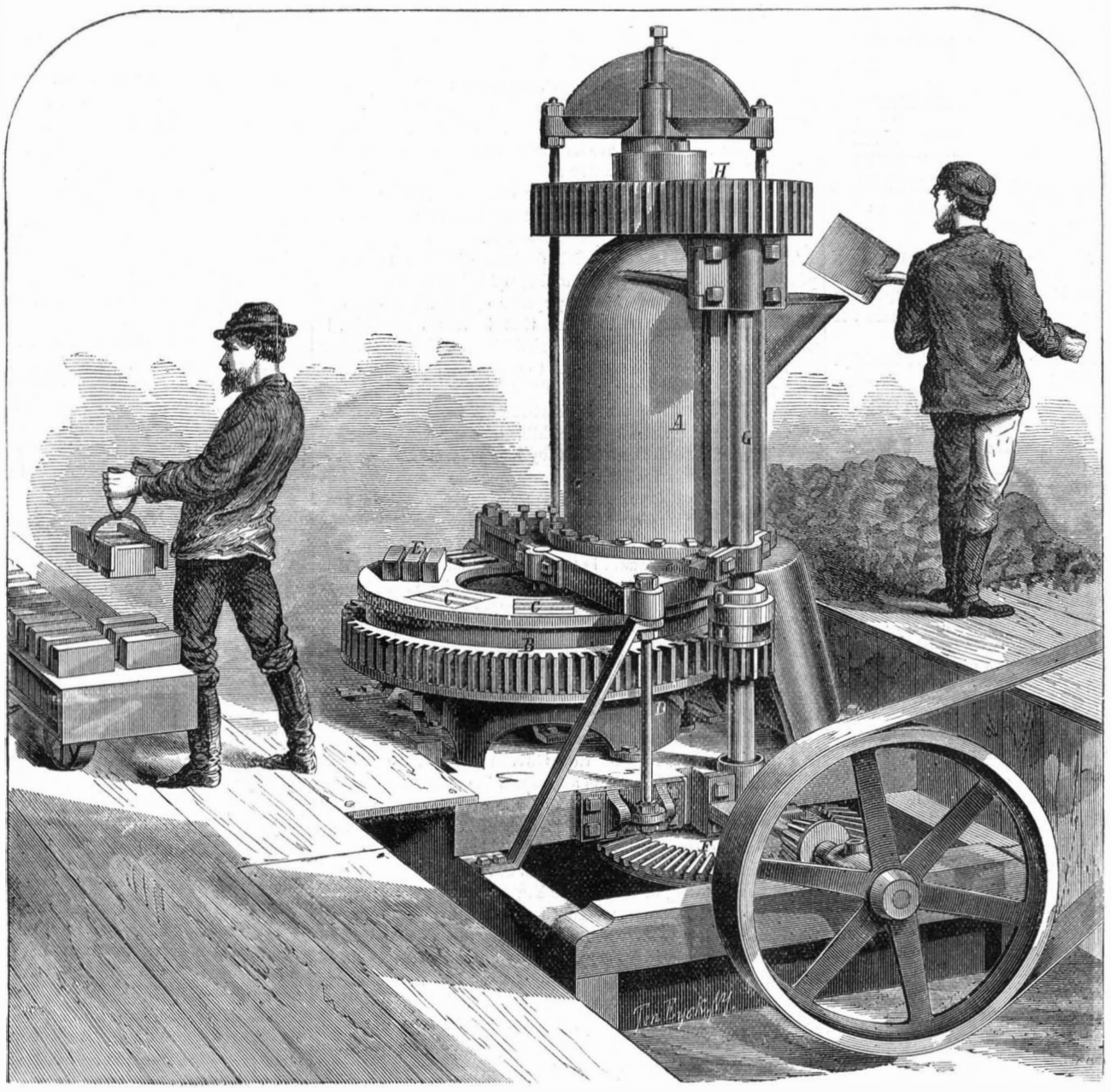
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVIII.--No. 3. [NEW SERIES.] NEW YORK, JANUARY 18, 1873. [$3 per Annum, IN ADVANCE.

IMPROVED BRICK MACHINE.

We illustrate this week a recently devised apparatus, known as the "Great American" brick machine, in using which, to quote the words of the inventor, "the brick maker has the satisfaction of knowing that, in five minutes from the time the clay is taken from its original bed, it has been thoroughly tempered into a uniform homogeneous mass, pressed into the nicest shaped brick, and placed into the hack, where no more handling is required until the brick are dry enough to enter the kiln." How these excellent results are obtained, the reader will find in the following description:



THE GREAT AMERICAN BRICK MACHINE.

A, in our engraving, is the pug mill; B is the mold wheel containing twenty-four permanent metal molds, C C C, arranged in groups of three; under the latter is a movable bottom or follower, not shown, provided with a roller and traveling on a circular track, D, which raises or depresses the follower at proper points in the revolution of the mold wheel. Motion is communicated by the main pulley in the foreground by bevel gearing to the upright shaft, G, on the lower part of which a horizontal pinion actuates the mold wheel, B; while near its upper end is suitable gearing, H, which rotates the beaters within the pug mill.

The clay is brought directly from its bed, and not moistened unless it is too dry in which case a little water is added. The figure on the right is represented as shoveling the crude material into the receiver of the pug mill, within which it is thoroughly ground, tempered, and reduced to a homogeneous mass of about the consistency of thick putty. Thence it is forced into one of the groups of molds, C, which is carried under it by the revolution of the mold wheel, B, a polished metal surface giving the proper smoothness and finish to the top edges of the brick. The follower under the mold wheel then travels up an incline, raising a group of bricks, E, from the molds, all the angles and faces being preserved smooth, sharp, and perfect. As each set of bricks rises from the mold, it is lifted off by the clamp represented in the hands of the figure on the left, and placed upon a double decked truck that is capable of holding one hundred bricks. When filled, the truck is wheeled away and its contents piled in hacks eight or ten bricks high. Each revolution of the mold wheel, therefore, turns out twenty-four bricks, and it is claimed that the machine can produce sixty-five per minute, or thirty-nine thousand in a working day of ten hours.

There is no doubt but that this apparatus is compact, of great simplicity, and economical, in that it produces brick without skilled labor. That it is a decided improvement over the old-fashioned methods of grinding up clay with a superabundance of water, molding in sanded wooden molds, and allowing the moisture to evaporate by spreading the brick in a sanded yard, is also evident. It is neither a "soft mud" nor a "dry clay" machine, but aims at a medium between the two extremes. To continue the list of advantages which the inventor claims, the clay is tempered in the machine itself, so that no separate process is necessary; no molding sand is required, the polished steel molds answering every requirement; no handling or washing of molds, nor edging or spatting of bricks is needed; the bricks are taken directly from the machine to the hack, where they remain while drying, protected from rain and frost. A smaller yard will give the same drying capacity, the hacks being only six feet apart; and, lastly, the bricks can be manufactured at a much reduced cost.

The inventor points to the severe test which his bricks withstood during the Chicago fire, when 50 per cent came out perfect. As an item of interest, we note that the patentee affirms that he has made five hundred millions of bricks since 1865, in Chicago and other points, and that the company working this invention has turned out eight millions during the past season.

For further information, address the Great American Brick Machine Company, E. R. Gard, President, No. 53 South Jefferson street, Chicago, Ill.

Ozokerit Candles.

So much money has been expended in advertising ozokerit that in England the public generally look upon the candles purporting to be made from it as, in fact, nothing more or less than the adamantine candles long furnished to the trade. The suspicion is, however, entirely unfounded, as the candles are really made of purified ozokerit, which is paraffin of the best quality. Ozokerit, or native paraffin, also called earth wax, was found embedded in sandstone near Slanik in Moldavia, in the neighborhood of coal and rock salt deposits. It was afterwards discovered in the Carpathians, from which latter source the English manufacturers obtain their principal supply. The crude mineral has a brown, green or yellow color, is translucent at the corners and exhibits a resinous fracture. It is naturally brittle, but can be kneaded like wax. When exposed to the air it becomes black and waxy, and when rubbed is negatively electrified and yields an aromatic hydrocarbon odor. The low melting point of 66° C, renders the admixture of certain other less fasible substances necessary in the manufacture of candles. The illuminating power of candles made from ozokerit has been expressed by the following comparison instituted by Dr. Letheby: To afford a given amount of light, must be taken of ozokerit candles, 754; paraffin candles, 891; wax candles, 1,150. The candles can be colored with mauve and magenta, and they then present a fine appearance.

English Prizes for Economical Stoves.

A friend of Sir W. Bodkin's has presented the sum of $2,500 to the Society of Arts, London, to be awarded in prizes or "otherwise" for the invention of improved stoves for securing economy in the use of coal for domestic heating or cooking purposes. The Council have accordingly announced five prizes, each of which will consist of the Gold Medal of the Society and $250, to be awarded as follows, provided the competing articles satisfy the judges. The announcement is as follows: The Society's Gold Medal and $250:

1. For a new and improved system of grate suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, answer best for warming and ventilating a room.

2. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, best answer for cooking food, combined with warming and ventilating the room.

3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room.

4. For the best new and improved system of apparatus which shall, by means of gas, be best adapted for cooking, combined with warming and ventilating the room.

5. For any new and improved system or arrangement, not included in the foregoing, which shall efficiently and economically meet domestic requirements.

The Council reserve to themselves the right of withholding all or any of the above prizes, as the judges appointed by them may determine.

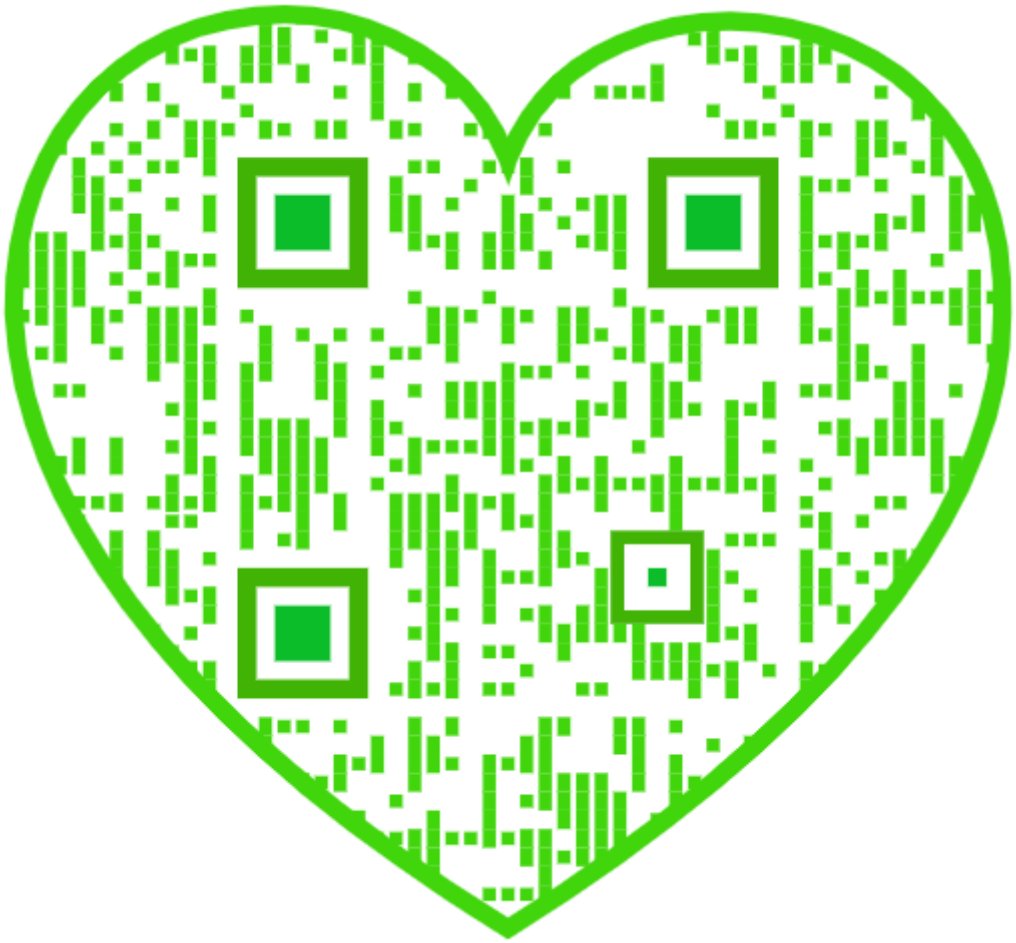
The competing articles must be delivered not later than the 1st of December, 1873, with a view to their being tested, and they will be subsequently shown in the London International Exhibition of 1874. Further particulars as to place of delivery and other arrangements will be published as soon as they are finally settled.

One moiety of the sum presented to the Society is thus disposed of, but what arrangements are in view for disposing of the other are not at present made public.

Mechanical Engineering in Cornell University.

It may be a word of encouragement to young mechanics in the shops to know that the Board of Managers of Cornell University have selected, for the head of its mechanical engineering department, Mr. John Edson Sweet, of Syracuse, N. Y., a young man who, with but a common school education, has risen from striker at the forge, through the machine-shop and drawing room, to be an instructor of engineering in this celebrated school. He has contributed, during the past year, a series of articles to *Engineering*, on "Mechanical Refinements."

© 1873 SCIENTIFIC AMERICAN, INC.



Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year - - - - - - - - $3 00
One copy, six months - - - - - - - - 1 50
CLUB RATES { Ten copies, one year, each $2 50 — 25 00
Over ten copies, same rate, each — 2 50

VOL. XXVIII., No. 3. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, JANUARY 18, 1873.

Contents.

(Illustrated articles are marked with an asterisk.)

American doctor in London, an.... 41
Aniline inks.... 36
Answers to correspondents.... 43
Austria, practical advice to exhibitors, in.... 33
Austrian show before the Senate, the.... 34
Boiler flues, collapsing.... 32
Boilers, steam pressure on.... 36
*Brick machine, improved.... 31
Business and personal.... 43
Caravan, the universal.... 36
Conflagrations, how to insure.... 39
Cornell University, mechanical engineering in.... 31
De Coudres, Louis.... 33
Disinfectants, experiments with.... 34
Drawing, the importance of.... 34
*Engine, nine horse power boat.... 38
Fires in cities, the spread of.... 41
Fires, the prevention of.... 36
Forests and drought.... 41
Insensibility.... 36
Kieserite, properties and uses of.... 33
Machinery, balancing.... 33
Mississippi, the bar at the mouth of the.... 36
Oils, testing the quality of lubricating.... 41
Oxidizing agents.... 32
Oxyhydric illumination.... 32
Ozokerit candles.... 31
*Paddle wheel, feathering.... 34
Patent decisions.... 41
Patented in England by Americans, inventions.... 41
Patents, official list of.... 43
Patents, recent American and foreign.... 42
*Pavilion, ball ground.... 39
Prospects for 1873.... 32
*Safety valve, compensated spring 34
Science and art, gleanings in.... 37
Scientific and practical information.... 40
Sewing machine monopoly, the.... 33
Spain, an international show in.... 33
Steam gage, an African.... 41
Steam pipes? Can buildings be set on fire by.... 32
Steam statistics.... 36
Stoves, prizes for economical.... 31
Tobacco, Turkey.... 39
*Tyndall's lecture on crystals and light, Professor.... 35
Vaccine virus.... 41
Vienna show, to intending exhibitors at the.... 33
*Wooden ties in stone edifices.... 34
Wood work, bent.... 40

CAN BUILDINGS BE SET ON FIRE BY STEAM PIPES?

The recent destructive fires have raised the question as to the safety of the use of steam pipes in heating buildings; and as in some instances the true cause has been enveloped in mystery (which is quite natural, as fire destroys all evidences) the Fire Marshal of New York has found it most expedient to throw the blame simply on steam, in those cases where the buildings were warmed by that agent.

As steam may be considered to be the most safe, healthy, and economical of all modes of heating buildings, such a suspicion is to be deplored, as it is apt to raise a prejudice against it; hot air furnaces may be considered dangerous, as proved by the well established evidences of the fire records, but not so with the steam heating. In fact, there is not any well authenticated case on record wherein pipes, through which steam passes, have actually set fire to woodwork, and no one experimentor has yet succeeded in igniting wood with such pipes. We maintain that any man of science who has studied the subject of steam, or any practical engineer of common sense, knows that all that steam can do, even when superheated, is to make the woodwork hot and dry, and to predispose it to catch fire. The spark must be supplied from another source; the steam tubes can never attain, outside the heating apparatus, the high temperature of 900° or 1,000° Fah. required for the red heat which is necessary to set woodwork on fire.

In this city many of the steam heating apparatuses are worked on a pressure not above 10 lbs. per square inch, in excess of atmospheric pressure, which gives a heat of 241° F. for the water in the boiler, and a somewhat less heat, of course, for the steam which circulates through the pipes. In the majority of buildings heated by steam, a common boiler is used, from which steam pipes are carried through the premises, and an ordinary pressure for such boilers is 40 lbs. per inch, which gives a heat of 289° F. At a pressure of 120° lbs. above the atmospheric pressure, we have a heat of 355°. It will thus be seen that at pressures, far above any that are used for heating purposes, the heat circulated in the steam pipes is much below that required for the ignition of wood.

That steam pipes predispose woodwork to combustion, and even may assist the spontaneous combustion which is apt to commence in rags soaked with any animal or vegetable oil, cannot be denied; but then any heating apparatus will do the same, and steam is in this respect not so dangerous as a draft of hot air proceeding from a furnace, in which a leak may carry a spark upward, while a leak from a steam tube is utterly harmless. In regard to spontaneous combustion, any danger of that, from oil, may be avoided by using for lubrication the heavy lubricating petroleum. This material is not apt to oxidation or spontaneous heating, as one of our esteemed correspondents discovered and published in our paper several years ago; which valuable property is now also being publicly recognized in Europe.

THE AUSTRIAN SHOW BEFORE THE SENATE.

It is probably needless to state, that the bill granting $100,000 as an appropriation for American representation at the Vienna Exposition having passed the House, the supporters of the scheme will concentrate every effort to induce the Senate to increase that sum, in order to allow of a raid upon the Treasury proportionate to the extravagant figures heretofore fixed upon by the United States Commissioner. The Senate undertakes the consideration of the measure with a full knowledge of the objections which ever since its reception have been strenuously urged, and with the advantage of the previous discussion on the merits and demerits of the bill.

We have traversed the whole ground so fully and so minutely that there is little, in addition to that which we have already presented, left for us to say. We would urge upon the Senate the simple fact that for this appropriation there is no necessity; because, first, as has already been stated by a representative, our citizens should know that for individual success they must depend upon individual enterprise, individual merit and individual energy, and that they are not to be nursed by the Government so that the few may be enriched at the cost of the great body of the people. Second, because we are sure of an adequate representation in any event. This is but a natural conclusion drawn from the precedent of previous European industrial expositions, in which nearly every large manufactory on the Continent exhibited devices of American origin. Corliss Steam Engines, McCormick Reapers, Amoskeag Steam Fire Engines, Howe, Singer, and Wheeler & Wilson Sewing Machines, Gwynne's Rotary Pumps, Burleigh Rock Drills, Blake's Stone Crushers, Blanchard's Lathes (in every country where they make gunstocks, lasts, spokes for wheels, or irregular forms of any kind), Whitney's Cotton Gins, Gatling's Mitrailleurs, Remington Rifles, Hotchkiss Projectiles, Tilghman Engraving, Root Blowers, Colt's Revolvers, Clothes Washers and Boilers, Silver's Marine Governors, Henderson's Process for Iron, Danks' Rotary Puddling Process, Hayden's Invention for Hollow Ware, Hyatt's Pavements, Print Writing Machines, American Pianos, and Hoe and Bullock Printing Presses are but a portion of the large number of our inventions in constant use abroad which it is safe to say will be found in the coming show.

We would remind Congress that our Centennial Exhibition is now a suppliant for a national subsidy, and that although the same objection to extending Government pecuniary aid to the advertising of private business holds here as well as in the case of the foreign show, still, of the two, if it is deemed expedient to grant such assistance, our own Exposition certainly merits the preference. We need not dwell upon the fact that there are hundreds of matters productive of more benefit to the country at large—the reduction of the national debt, the renewing of our commerce, and the improvement of the navy are but examples—to which every spare dollar in the Treasury could be advantageously applied.

The Centennial has met with decided disfavor from the people, as shown by the withholding of individual subscriptions. Such an expression of popular opinion has but one unmistakable interpretation, and that is that the public, if they refuse to countenance an exhibition, which will draw the industries of other countries to our own borders, which presents no obstacles to the safe display of the world's best products, which at the same time will afford an opportunity for aggrandizing ourselves by the exhibit of our wonderful progress during the past century, they look with still less approbation upon a plan which presents not only an equal but a larger number of disadvantages, with a far less proportionate amount of benefits to be gained.

We trust that, so far from increasing this appropriation, a plan which we understand is to be advocated, the Senate will either strike it out altogether or, if it must be passed, curtail its figures. In reference to the latter event, it may be well to remember that the Chairman of Foreign Affairs in the House, during the recent debate, made the following assertions: "The Secretary of State has sent to the Austrian Government the project of a law that will entirely protect the inventors of this country. That has been received by the Government of Austria, and the Secretary of State expects that it will be approved by that Government. No expenditure will be made under this appropriation except with the approval of and by the direction of the Secretary of State." A strong intimation was added to the effect that, until this law was passed, no disbursements would be made. We would call attention to the fact that it is now several months, according to the showing of the United States Commissioner, since this "project" was forwarded to Austria, and that ample time has elapsed to have some action taken. The feeling in this country is well known to that government, and has been commented upon in the Vienna journals. It is therefore advisable, in view of the rapidly approaching time of opening of the Exposition, April next, that an amendment embodying the above proviso be inserted, in case an appropriation is granted, merely as a protective measure.

COLLAPSING BOILER FLUES.

A correspondent, O. L. M., writes from Niles, Trumbull county, Ohio, to inform us of an accident which affords another illustration of the criminally careless or ignorant engineering which annually destroys so many lives, and which, we regret to be compelled to confess, finds a larger number of victims in the United States than in any other country on the globe. The fact is due probably more to the proverbial recklessness of our people than to any other defect in our national character. So far as it is a consequence of ignorance, we may hope that the pages of the SCIENTIFIC AMERICAN and its engineering contemporaries may be found to furnish a valuable preventive; experience only can teach our reckless people prudence, or even that a good business policy dictates greater caution in proportioning and working steam boilers.

In the case mentioned, the steam boilers of a blast furnace are forty-eight inches in diameter, thirty feet long, and have each two flues seventeen inches in diameter, and three sixteenths inch thick.

The usual pressure carried is forty-five pounds per square inch. Recently, while the engine was standing, the steam pressure rising to fifty-five pounds, one flue was collapsed its entire length. Our correspondent desires to know "what was the cause of the accident." The boiler was well supplied with water, and everything apparently all right.

The cause was, undoubtedly, simply weakness in the flues. They were, probably, a little out of shape when put in, had become somewhat weakened by use, and finally collapsed when the pressure was a little higher than usual. If these flues had been *perfectly round*, they would have had a collapsing pressure, when new, of about $606{,}000 \times (\frac{3}{16})^2 \div 30 \times 17 = 55{\cdot}5$ lbs., as determined by the rule which Fairbairn deduced from his experiments on the strength of flues.

The laps of the girth seams would strengthen the flues to a slight extent, and, in this case, about an equally slight weakening had taken place by loss of shape and by use, so that the collapse finally occurred at just the pressure indicated.

These flues should have been made at least one quarter inch thick, or should have been strengthened by properly fitted rings of angle iron at intervals of seven and a half feet. A good engineer, designing such boilers with a view to making good work and sustaining his reputation rather than deferring to a penny-wise, pound-foolish spirit of economy, would have made them of 5-16, or even 3-8 inch boiler plate. Although our law dictates that boilers should have, when new, a strength only about four times greater than their working pressure, good engineers are inclined to make the "factor of safety" six or more in every part.

The other flues of these boilers should be looked after at once, or they may produce a more serious disaster. It would also be well for those whose lives and property are jeopardized, to ascertain how it happened that, where steam was nominally carried at forty-five pounds, the pressure could by any possibility rise to fifty-five.

PROSPECTS FOR 1873.

We are gratified to be able to state that the subscriptions to the SCIENTIFIC AMERICAN for the new year of 1873 are pouring in from all directions, and there is every prospect that our regular edition for the year will reach the round number of *Fifty thousand copies per week.*

We hope our friends who have not yet renewed and all who are engaged in the formation of clubs will send along their names as rapidly as possible. To prevent the loss of back numbers to those whose remittances are a little tardy, we electrotype each issue and preserve the plates, whereby we shall be enabled to print new editions of any numbers that may be required.

The terms of the SCIENTIFIC AMERICAN are $3 a year · $1.50 for six months.

DU MOTAY'S PROCESS FOR OXYHYDRIC ILLUMINATIO

Our excellent cotemporary, *Les Mondes*, a Parisian scientific weekly, translates our recent article upon oxyhydric illumination, from which, to use its own words, it derives "affliction and consolation at the same time." Speaking of M. Tessié du Motay's system, it says: "Misunderstood in France, the inventor and the invention are received and applauded abroad—in England, Germany, Belgium, and America. The glory of the one and the benefits derived from the other will be the consequence of this unfortunate importation."

Our cotemporary strongly dissents from the adverse report of M. Le Blanc, and adds that proof of the value of the process are pouring in from all sides. The best, it continues, is the demonstration recently made that, by the inventions of M. du Motay, the cost price of about 35 cubic feet of hydrogen is reduced to two cents, and that of a smaller quantity of oxygen to the price of about 13¼ lbs. of coal or other fuel. The lowest quotation of coal, as now selling in Paris, given by the commercial journals, is $10 per tun; so that 2¼ lbs. of fuel costs about one cent; consequently oxyhydrogen gas is worth, per thousand cubic feet, a fraction over $1.14. In this city and the environs, ordinary street gas varies from $2.80 to $3.50 per thousand feet.

The economy of the process is obvious from the fact of fuel in this country being much cheaper. Ten dollars per tun is far above our market rates. Taking into consideration the mechanical nature of Du Motay's process, and even allowing for the increased expense of labor in this country, we should judge, from the above, that this improved and excellent mode of illumination might be supplied at a cost not exceeding one half, or, at most, two thirds that of the inferior gas now in use.

OXIDIZING AGENTS.

We are frequently asked by correspondents to name some of the leading agents employed by chemists, to produce what is called oxidation. The operation is an important one in the arts, as upon it depends the success of bleaching, disinfection, and similar processes. We will mention some of the methods now preferred by chemists for the purposes indicated.

Ozone, if it could be cheaply made, would be almost invaluable, but the cost of production stands in the way of its common use. The permanganate of soda or potash is a chemical compound that cannot be excelled in its oxidizing properties, and its use has gone on steadily increasing for years. In England, under the name of Condy's fluid, it is a common article about the household, and for hospitals and bleacheries it is coming into vogue. A little more knowledge of its value would soon lead to its production on a large scale.

Bleaching powders have long been known and used as oxidizers, and, as they can be had in any quantity, are likely to continue to be employed.

Chromic acid, whether in saturated or dilute solutions, has the power of converting carbonic oxide into carbonic acid, readily and completely under ordinary temperatures. Ammonia gas is powerfully oxidized by it, and it readily destroys organic matter. The chlorates and nitrates can also be mentioned in this connection.

© 1873 SCIENTIFIC AMERICAN, INC.

PROPERTIES AND USES OF KIESERITE.

Kieserite is a mineral composed of sulphate of magnesia and water, which occurs to the extent of 12 per cent in the salt deposits of Stassfurt, Germany. It differs from Epsom salts by its difficult solubility in water and smaller percentage of water of crystallization.

The first attempts to economize kieserite were made in 1864, when it was proposed to employ it in the preparation of sulphate of potash. Since that time the applications have greatly increased, and it has now become an important article of commerce. The largest quantity of the raw material is sent to England, where it takes the place of the sulphate of magnesia, formerly manufactured from dolomite, or Grecian magnesite, in cotton printing. Another portion of kieserite is converted into Glauber salts which, on account of its freedom from iron, is highly prized by gas manufacturers.

Manufacturers of *blanc fixe* employ kieserite instead of sulphuric acid to precipitate the sulphate of barium from chloride of barium, and in all similar cases where it is proposed to prepare a difficultly soluble sulphate, the kieserite can be advantageously used. Kieserite is recommended as a substitute for gypsum in agriculture, as a top dressing for clover, and is largely employed in England for this purpose. It is proposed to use kieserite in the manufacture of alum. There is a mineral called bauxite which chiefly consists of the hydrated oxide of aluminum; this is easily dissolved in hydrochloric acid. Cheap potash salts and the calculated quantity of kieserite are added, alum crystalizes out of the solution, and chloride of magnesium remains in the mother liquor.

The uses indicated above are wholly inadequate to consume the enormous quantities now obtained from the Stassfurt mines. Millions of pounds of kieserite are annually brought to the surface, and it is becoming a serious question to know what to do with it. If it could be used as a substitute for gypsum in building materials and cements, its cheapness would at once commend it to notice. Experiments looking to this application have been tried.

Two equivalents of kieserite and one equivalent of caustic lime were stirred to a paste in water. The mass hardened, but remained granular and brittle. On calcining it, however, again pulverizing and moistening with water, it set to a solid marble-like mass, which could be applied to many useful purposes. It is proposed to employ this material for ornamental decorations in the interior of houses and in general for the manufacture of cements and as a substitute for plaster of Paris.

Kieserite appears likely to prove a valuable accession to our supply of useful minerals, to be ranked by the side of kainite, a potash mineral also found at Stassfurth and now largely imported into the United States.

BALANCING MACHINERY.

In designing and constructing machinery, it frequently becomes necessary to make provision for balancing the weights carried by rotating shafts, and for neutralizing the effects of forces developed by the motion of either rotating or reciprocating parts. Mechanics are in the habit of distinguishing between a "standing" and a "running balance." When a heavy piece is carried upon an axis, in such a manner that it is not balanced on that axis, it exerts an effort to turn itself about the shaft until it comes to rest with its center of gravity in the lowest possible position. This effort is measured by what is called a *moment*. A moment is the product of any force into its lever arm, the latter quantity being the shortest distance from the line of direction of the force to the axis about which it tends to produce motion. In the case of a crank on its shaft, the force is the weight of the crank acting vertically downward through its center of gravity, and the lever arm is the distance from the center line of the shaft to the vertical, through the center of gravity of the crank. The moment would have a maximum value when the crank lies horizontally, and would be one thousand foot pounds were its weight five hundred pounds and its center of gravity two feet from the center of the shaft, or were the weight seven hundred and fifty pounds and this distance sixteen inches, or again, if the weight were two hundred and fifty pounds and the lever arm four feet. If opposite this crank another heavy piece is placed, of such weight and at such a distance that its moment, tending to produce rotation in one direction, is equal to that of the crank tending to turn the shaft the other way, the latter will be balanced. This will be shown by the fact that the shaft, if unacted upon by any other forces than the weights of the crank and its counterbalance, will remain in any position in which it may be placed. In this case we have an illustration of the "standing balance." Should it have happened that the counterbalance, although exerting an equal moment, was not of equal weight with the piece which it was intended to balance, it would be found that, upon setting it in motion at a sufficiently high rate of speed, the shaft would shake in its bearings; or if they were set up tight, the whole machine and even its foundation might shake in consequence of the unsteadiness of the rotating parts.

It would thus become evident that a standing balance and a running balance are not secured by similar conditions. In fact, we have to deal with quite different forces. In the first case we have to equilibrate the force of gravity; in the second, we have to neutralize the effects of the force of inertia as developed by bodies in motion. The force of gravity has an effect simply proportioned to the weight of the piece, while inertia produces an effort proportional to the weight of the mass and, also, to the square of the velocity with which it moves. When a piece swings about a center, as in the case of the crank just considered, or of a stone in a sling, the force with which it tends to break its connection with the center, its centrifugal force, is due to a constant tendency to move in a straight line, and is a consequence of its inertia. The intensity of this force is measured by the product of the weight of the body into the square of its velocity per second, divided by sixteen and one twelfth times the diameter in feet of the circle in which it moves. Algebraically expressed, this force is $F=\frac{WV^2}{16\frac{1}{12}D}$

We may assume, without great error, that this force acts at the center of gravity of the piece. Then our crank, weighing 500 pounds, would have a centrifugal force, at 50 revolutions per minute, of $\frac{500\times(2\times3\cdot1416\times\frac{5}{6})^2}{16\frac{1}{12}\times4}=213$ pounds. At 100 revolutions per minute, this would become four times as great, or 852 pounds, and at 150 revolutions the force would become 1917 pounds. Such forces as are thus developed at high speeds frequently have very serious effects, and it sometimes becomes absolutely necessary to secure a good running balance by neutralizing them. Were it attempted to effect a balance by a piece placed opposite, at a double distance, but of half the weight, the counterbalance would have a double centrifugal force, and hence, although a standing balance would be obtained, it would not give a running balance. To secure the latter, it would be necessary to reduce the weight of the counterbalance one half, and this, in turn, would destroy the standing balance.

En resumé, the condition of a standing balance is that the moments of the weights carried by the axis shall neutralize each other. The condition of a running balance is that each piece shall have a counterbalance of equal *vis viva*. By *vis viva* is meant the quantity obtained by multiplying the weight of a moving body by the square of its velocity.

The condition of a combined standing and running balance is that each rotating mass shall have a counterbalance of equal moment and of equal *vis viva*. This is complied with when the counterbalance is of equal weight, and equally distant from the axis with the piece which it balances. If there are several masses revolving on the same shaft, it may happen that, although no two have the same *vis viva*, the sum of the excesses may equal the sum of the defects, and an equilibrium may still occur. In most instances where the balance is secured in such arrangements by trial, this latter case is exemplified.

In high speed engines, and notably in locomotives, it becomes necessary to balance the reciprocating parts. In this case the same principles apply as in procuring a running balance of rotating parts, and the problem is solved by securing equal and opposite *vis viva*.

We will continue this article in a subsequent number of the SCIENTIFIC AMERICAN.

THE SEWING MACHINE MONOPOLY.

An extended article on the application of A. B. Wilson, for another extension of his sewing machine patent, is in type, but is necessarily crowded out this week for want of space.

Sewing machine manufacturers and patentees who are not members of the gigantic sewing machine monopoly should bestir themselves at once if they would avert another seven years' servitude to this oppressive combination. Action should be taken immediately, and every honorable means be adopted to prevent Congress from passing the bill, should the Committee on Patents be wheedled into recommending it. An inexpensive and practical mode of enlightening the people throughout the country in regard to this scheme, which pecuniarily effects every user of sewing machines, will be to send circulars to every postmaster, merchant and manufacturer in the United States explaining how excessive has been the profit exacted from every seamstress and family now using sewing machines, and the heavy tax which every new purchaser will have to pay in consequence of the existence of the sewing machine monopoly, and which another extension of the Wilson patent would further perpetuate. With this circular (requesting the obtaining of as large a list as possible in the shortest time) should be sent a blank petition for the signature of persons opposed to the extension, with a request to forward to the member of Congress from the District where the names are obtained, as soon as a number of signatures are registered.

TO INTENDING EXHIBITORS AT THE VIENNA SHOW.

Mr. Van Buren, the United States Commissioner, in a recent card reminds intending exhibitors that they should hurry up or it will be too late to send their goods. He expects that Congress will pay for freighting the articles over to Austria. But exhibitors may expect to pay pretty freely to have their merchandise looked after and displayed on arrival. This was the case at the Paris Exposition, and the Austrian charges will be much higher. The late war has greatly increased the prices of living in Vienna. The great show will be a money harvest for the people of that city.

PRACTICAL ADVICE TO EXHIBITORS IN AUSTRIA.

The worthlessness of the pretended protection offered by the Austrian government to exhibitors, at the coming Vienna show, is set forth in the accompanying letter from Mr. Hotchkiss. This gentleman is an American patentee who, in the course of regular proceedings under the Austrian patent laws, has become practically acquainted with their working, and his views may be relied upon. We advise intending exhibitors to profit by his advice.

To the Editor of the Scientific American:

I am very much gratified to see the articles in your valuable paper concerning Austrian and other European patent laws, and the gross injustice now practiced under them. There are two or three important points which I have not touched upon in connection with the working of patents in Austria, and in connection with the Exposition certificates proposed.

I would advise inventors designing to exhibit at Vienna not to avail themselves of the proposed exposition protection, but to apply for their patents before the exposition of their goods takes place, for the reason that an Austrian may take a patent for the same thing, during the existence of the Exposition protection, and claim that he was the original inventor, thus creating a dispute between the holder of the patent and the holder of the certificate of protection.

In taking patents the inventor should be particular about his drawings and specifications, and not describe more than one mode of accomplishing his object, for the Austrian patent office demands, if an inventor describes two, or three, or more different ways in which his invention can be made, that, in working his patent within the first year, he shall work it in all the different modes described in his patent, no matter how indifferent some of the modifications may be.

Under the present working of the patent office, where an invention has several modes or modifications described, they allow you to prove the general principle working, and then afterwards demand of you to prove that you have worked some one of the modifications; and if you fail to prove that you have worked any one of them, no matter how trivial or insignificant a matter it may be, the patent becomes void.

Inventors must not expect to have any favors or liberality shown them under the Austrian patent laws.

I hope that you will give publicity to these suggestions and facts, for the benefit of those who propose to be exhibitors at Vienna.

B. B. HOTCHKISS.

Paris, December 20, 1872.

AN INTERNATIONAL SHOW IN SPAIN.

A grand international exhibition is to be held in Spain in 1875; and if the policy of paying out the money of the United States to assist foreign shows is to be continued, of which the Austrian exhibit is an example, we hope that poor Spain will not be forgotten. She really needs help.

If the public funds *must* be used for such wrongful purposes, we suggest that a fair division be made, and we hope that some of the Senators will introduce an amendment to the bill of Commissioner Van Buren, which calls for one hundred thousand dollars for Austria, so as to give half of the amount for the Spanish show. Fifty thousand dollars is quite enough to support our Commissioner for six months in Vienna.

Louis de Coudres.

Died, in Brooklyn, N. Y., on the 16th ult., Mr. Louis De Coudres, in the 83d year of his age.

Mr. De Coudres was one of the very few yet living who had a hand in fabricating the machinery of the first steamboats. At the early age of thirteen, he was taken by James P. Allaire as his first apprentice, Mr. Allaire at this time carrying on a small brass and bell foundry. It was at this establishment that the brass castings were made for Mr. McQueen, who had machine works and did the work for Robert Fulton in applying his steam engine to the first paddle wheel steamboat, the North River, of Clermont. Several years later, Mr. Allaire started his steam engine works, in Cherry street, which became the leading establishment of the city and famous over the entire country for the number and character of the engines it supplied to the first steamboats which plowed the waters of this continent. Mr. De Coudres continued with Mr. Allaire more than half a century, some of the time as superintendent of the iron foundery and all of the time in charge of the brass casting department, in which art his reputation was pre-eminent. This branch of the Allaire works possessed for many years almost a monopoly of the trade of bell casting. The first great fire alarm bells, put up in the City Hall park, were cast here by Mr. De Coudres. He was in his 83d year, and was probably the oldest brass founder in this country.

THE Citizens Association of Des Moines, Iowa, invites men of capital to come there to build new factories and to enlarge the factories already established. Those for agricultural implements and farm machinery are greatly needed. Starch factories, cotton mills, factories for boots and shoes, hats and caps, canning fruit, and sewing machines, are also required; copper and brass founders, glass works, cooperage, furniture, chairs, baskets, brushes, etc., are all here offered manufacturing inducements. A vinegar factory, possibly a tannery, and many other establishments, and indeed every department of productive industry, must contribute to the great demand of this new and extensive business field.

A TRANSANDINE RAILWAY.—A transandine survey, made jointly by the Argentine and the Chilian Governments, leaves little doubt of the possibility of railway communication between the Atlantic and Pacific. The length of such a communication would be about 1,200 miles, of which nearly 400 miles are actually made.

IMMUTABILITY OF SPECIES.—Cats and dogs embalmed in Egypt four thousand years ago are precisely like those of today, said the late Sir David Brewster. What have the revolutionists to say to that fact? Four thousand years are nothing, so gradually are organic changes brought about—would probably be the Darwinian answer.

"I HAVE been a constant reader of the SCIENTIFIC AMERICAN for many years," says a renewing subscriber, "and would not be without it for many times its cost. It has been the key to unlock many problems which have agitated my mind."

© 1873 SCIENTIFIC AMERICAN, INC.

IMPROVED FEATHERING PADDLE WHEEL.

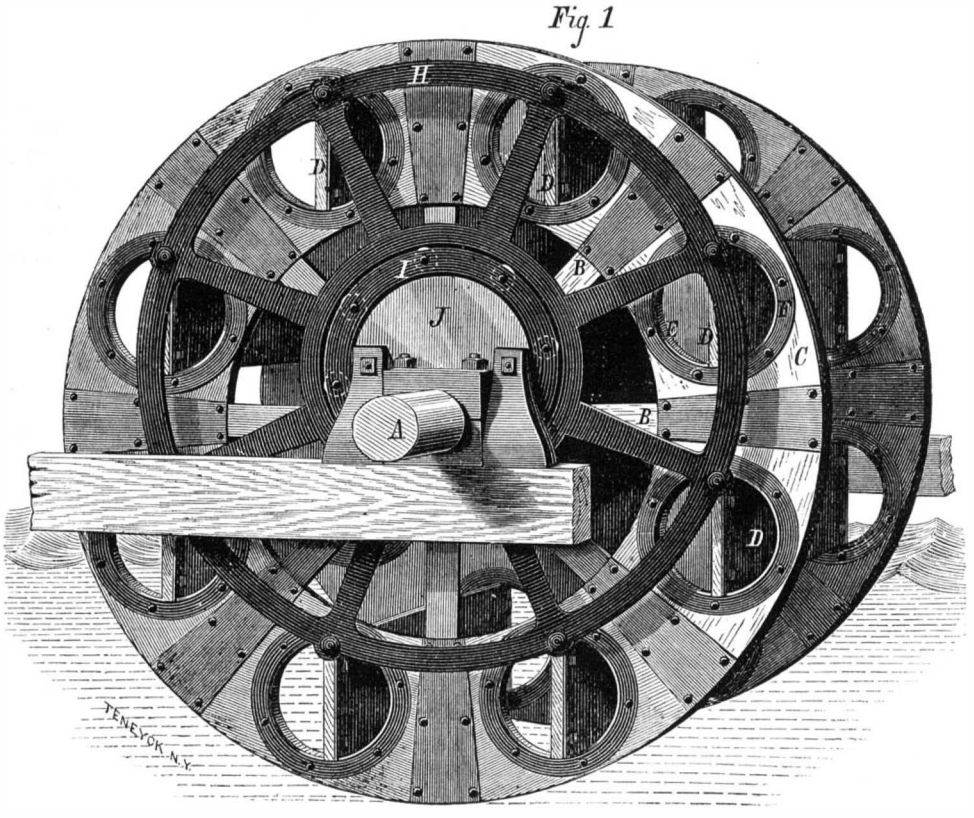
The invention illustrated in the accompanying engraving is a feathering paddle wheel, or, in other words, a wheel in which the paddles are so arranged as to remain during their motion in a vertical or very nearly vertical position. They are thus prevented from lifting up bodies of water or from striking the water without acting fully and fairly to propel or otherwise give a useful effect.

Fig. 1 gives a general perspective view of the device, and Fig. 2 shows the manner of supporting the paddles in the wheel rim. A is the axle held in suitable bearings upon the frame. B B are the wheel arms connected with the axle and supporting the rims, C. D, the paddles, are secured by bolts passing through flanges of the semicircular cast iron segment, E, Fig. 2. The latter form, when combined, a narrow cylinder which turns in the wheel rim, C, and is guided by the flanges, F, secured thereto. By means of the journals shown, the segments are connected to the eccentric ring, H, which forms a united body with radial arms and an inner ring. J is a center bearing permanently attached and supported by braces to the wheel frame, having on its outer circumference a number of friction rollers, so that the inner eccentric ring rotates freely around it.

It is evident from the foregoing construction that, as the wheel is revolved by the shaft, the rim, C, and the paddles, D, are rotated about the axis of said shaft. But the paddles, being connected with the eccentric ring, H, will be moved relatively to the wheel rim, C, in accordance with the eccentricity of the ring as it revolves about the bearing, a. The result of the combined motions is that the paddles and segments, E, are so turned in the wheel rim as to preserve a vertical position during a full revolution thereof. The segments, E, rotating in their housings, are always firmly guided and supported on all points of the circumference, thus resisting strains and contusions, whether arising from currents of water, ice, drift wood, or other obstacles.

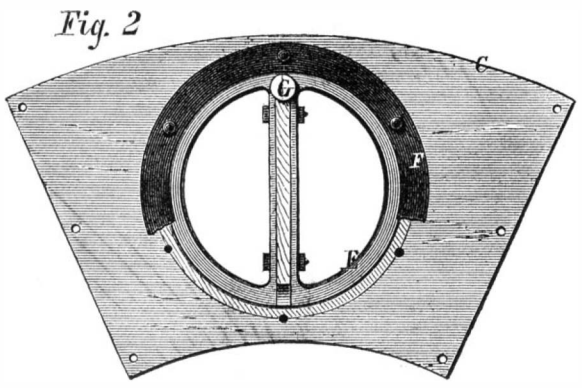
The journals by which the eccentric ring is connected being situated at the upper edges of the segments, the feathering movement of the paddles is in the direction of the water pressure, as produced by the current made by the wheel, so that to obtain such movement but little power is required. It is further claimed that, by the arrangement of the roller center, I, the power required in actuating the eccentric ring is reduced to a minimum.

Fig. 1



EMERSON'S FEATHERING PADDLE WHEEL.

Fig. 2



This invention is notably simple in form, in that it avoids the use of projecting cranks for feathering, while its general construction is such as to afford every requisite of strength and durability. It may be readily adapted to any form of wheel now in use. The inventor informs us that a similar wheel was placed upon the steam canal boat Port Byron, recently illustrated in our columns, which vessel has made a remarkably quick passage from Buffalo to New York.

Patented Sept. 28, 1869. For further information address the inventor, Mr. Primus Emerson, Carondelet, Mo.

Experiments with Disinfectants.

As the result of a series of experiments with disinfectants, Herr Eckstein, of Vienna, strongly recommends chloride of lime as the cheapest and best. Bleaching powders rapidly decompose all hydrogen compounds, such as ammonia, sulphuretted hydrogen, sulphide of ammonium, phosphoretted hydrogen; and these are the gases which occasion miasma. It acts rapidly by liberating oxygen, and its chlorine violently decomposes organic matter. At the same time bleaching powders are a cheap commercial article, and hence always accessible. In order to avoid the inconvenience often resulting from the liberated chlorine, the ingenious device has been tried of enclosing the bleaching powders in a bag made of parchment paper. This bag remains quietly where it is placed, and by the principle of endosmose and exosmose, the full effect of the liberated chlorine is attained without any inconvenience to the occupants of the house.

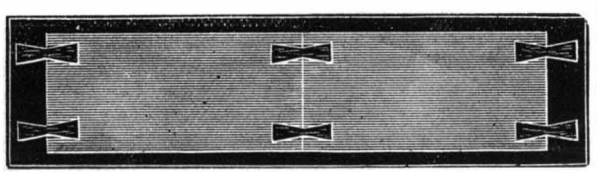
Herr Eckstein made comparative experiments with different disinfectants, for two years, with the following results:

1. Two pounds of sulphate of iron dissolved in water and poured into a saucer at first liberated sulphuretted hydrogen, and after twelve hours no longer produced any effect.
2. A solution of sulphate of copper behaved in the same way.
3. Two pounds of crystals of green vitriol retained its action for two days.
4. A mixture of sulphates of iron and copper and carbolic acid lasted two days.
5. Sulphurous acid was suffocating, and ceased to act in one day.
6. Carbolic acid produced a worse smell in the house than the bad gases of the sewer.
7. Two pounds of sulphate of iron in a parchment bag retained its valuable property longer than when exposed free.
8. Two pounds chloride of lime in a parchment bag continued to purify the air for nine days.
9. Permanganate of soda was successful as long as it lasted, but is too expensive.

Enclosing chloride of lime in a parchment bag, and suspending it in an out-house or leaving it in a sewer, is recommended, by the experimentor, as the best disinfectant to be obtained in the market.

Wooden Ties in Stone Edifices.

All the great temples of Egypt which have withstood the destructive tendencies of time and the assaults of man for four thousand years are of hewn sandstone, with a very few exceptions of about the color and character of the brown stone houses of New York. But the only wood in or about them is ties, holding the end of one stone to another on its upper surface. When two blocks were laid in place, then, it appears that an excavation about an inch deep was made thus, this being a representation of two hewn blocks, into which the hour-glass-shaped tie was driven:



It is therefore very difficult to force any stone from its position. The ties appear to have been the tamarask, or shittim wood, of which the ark was constructed, a sacred tree in ancient Egypt, and now very rarely found in the valley of the Nile. Those dovetail ties are just as sound now as on the day of their insertion. Although fuel is extremely scarce in that country, those bits of wood are not large enough to make it an object with Arabs to heave off layer after layer of heavy stone for so small a prize. Had they been of bronze, half the old temples would have been destroyed ages ago, so precious would they have been for various purposes.

Probably all those monster edifices were raised, course after course, secured in that manner, carefully adjusted by being admirably jointed above and below, but left rough inside and out. When carried to the proposed elevation, then, supported on moveable stays, the workmen dressed both surfaces from top to bottom, leaving figures in relief or the deeply cut symbolic characters which so puzzle archæologists in these latter days.

If our stone buildings were reared in the same manner, of blocks the thickness of the walls, they would certainly be more substantial than those slightly built houses which have their weakness concealed by a casing of thin sheets of brown stone. A difference of climate necessarily modifies architecture, but it is undeniably true that the architects of a remote antiquity, whose structures are monuments of their practical wisdom, were men of genius and extraordinary attainments in a department of art and science combined, not to be undervalued in these times of haste which end in waste.

The Importance of Drawing.

The Select Committee of the House of Commons on Scientific Instruction recommend, in their report, that instruction in drawing should be given in elementary schools. The disregard of such elementary instruction, as a branch of general education, is surprising. Drawing is a universal language; it is easier of acquirement than writing. By the use of a ruler, pencil, and compasses, a child may become self-educaated, and acquire a handicraft of essential service in after life.

The exclusion of drawing and geometry from the subjects of examination by the Council of this Society on the recent revision of the subjects of local examination, is greatly to be deplored. Encouragement in this acquirement might thus be given to those who can never attain mediocrity either in reading, writing, or arithmetic; and who can tell what may be the aid to development thereby afforded to the natural born talent of an artist?

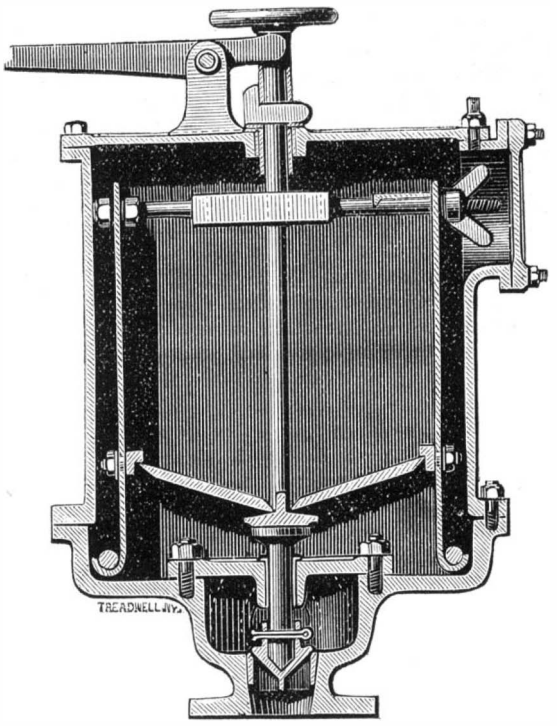
I look upon linear drawing and geometry, says Mr. Buckmaster, as the very foundation of instruction, and as affording, at a more advanced stage, the means of separating and classifying minds into orders or classes, so as to utilize each to the utmost, according to the powers with which it is endowed.

The neglect of drawing, at the earliest stage of the use of a pencil by a child, may be regarded as a great defect in our system of teaching, which our educational authorities have done much to remove.

What reason can be suggested why a child should not commence geometrical and mechanical drawing contemporaneously with learning to write? Indeed, so soon as it has the power of handling a pencil, the discipline of learning to draw would be equal to the discipline of learning to write. The want of this simple first elementary knowledge is declared by competent authority to be a great barrier to the success of artizan students.

TURTON'S COMPENSATED SPRING SAFETY VALVE.

The object of the peculiar arrangement of the safety valve illustrated herewith is to diminish the load on the valve as



the latter rises, and thus to allow a greater amount of lift than is possible so long as this load remains constant. The device, which we extract from *Engineering*, is the invention of Mr. Thomas Turton, of the Liverpool Forge Company.

The spindle, as shown bearing on the valve, is prolonged upwards into a casing, and, between a collar on the spindle and a pair of single plate springs contained in the casing, are disposed a pair of strut bars. These bars form a toggle joint, and as the valve rises they assume a more nearly horizontal position, the effect being that the downward thrust they exert on the valve is diminished. The plate springs are hinged at the bottom to fixed fulcra, and at the top they are connected by an adjusting screw, by means of which the pressure they exert can be regulated.

Further details will be readily understood from the engraving. The invention seems to be one of utility, and, if properly proportioned, should act well. There is a great demand for an efficient device of this kind.

THE President of the Royal Society of Agriculture, England, offers a prize of $500 for the best treatise on the diseases of the potato and the means of avoiding and remedying the same. The conditions of the competition may be obtained by addressing Mr. H. M. Jentrins, Secretary, 12 Hanover Square, London

© 1873 SCIENTIFIC AMERICAN, INC.

PROFESSOR TYNDALL'S THIRD LECTURE IN NEW YORK. CRYSTALS AND LIGHT.

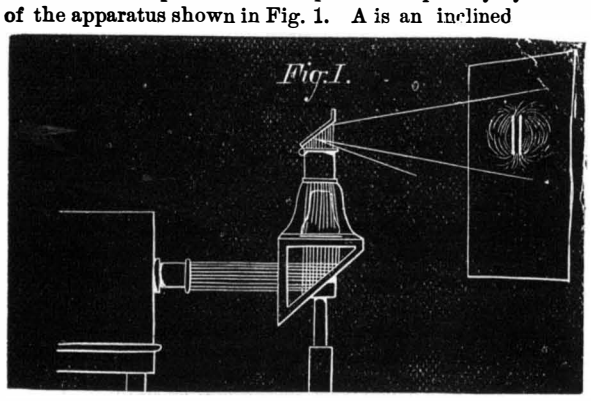
After a brief review of the preceding discourses, Professor Tyndall began his third lecture by referring to the manner in which scientific theories are formed. They take their rise, he said, in the desire of the mind to penetrate into the sources of phenomena. We have learned that in framing theories the imagination does not create, but that it expands, diminishes, molds and refines materials derived from the world of fact and observation. The germ of the conception that the sun and planets are held together by a force of attraction is to be found in the fact that a magnet has been previously seen to attract iron. In our present lecture the magnetic force must serve us still further; but what we must master here are elementary phenomena.

THE GENERAL FACTS OF MAGNETISM

are most simply illustrated by a magnetized bar of steel. Placing a bar magnet some two or three feet in length before the audience, the lecturer then showed its effect upon a magnetic needle. Holding the latter near the bottom of the bar, one end promptly retreated; raising it along the magnet, the rapidity of the oscillations decreased as the force became weaker, and at the center they entirely ceased. Passing further upwards, the end which had previously been drawn toward the magnet retreated, and the opposite extremity approached. This doubleness of the magnetic force is called polarity, and the points near the ends of the magnet in which the forces seem concentrated are termed its poles. Professor Tyndall then explained that the separate halves of the magnet would each be a perfect magnet having two poles, and if a hardened and magnetized piece of steel be broken into any number of bits, the same would be true. This thing that we call magnetic polarity is resident in the ultimate particles of the magnet. Each atom is endowed with magnetic force.

TENDENCY OF MAGNETIZED PARTICLES TO ASSUME DEFINITE FORM.

If we place a small magnetic needle near the magnet, it takes a determinate position, which might be theoretically predicted from the mutual action of the poles. A needle of simple iron will be affected similarly to the magnetic needle, or it is magnetized by the bar magnet. The action of two or more rods of iron near the magnet is more complex, for they act on each other. If we pass to smaller masses of iron—to iron filings, for example—we find that they act substantially as the needles, arranging themselves in definite forms in obedience to the magnetic action. The speaker then showed that, by sprinkling iron filings on a sheet of paper held over the bar magnet, various forms were produced. This experiment was represented optically by means of the apparatus shown in Fig. 1. A is an inclined



B a lens above which are two small magnets around which iron filings were scattered, and C a prism deflecting the ray to the screen, where the image appeared as represented. Professor Tyndall said that he had never seen more beautiful specimens of these curves than those recently obtained by Professor Mayer of Hoboken, "a young professor," he added, "from whom I expect considerable things."

Every pair of filings possesses four poles, two of which are attractive and two repulsive. The attractive poles approach, the repulsive poles retreat, the consequence being a certain definite arrangement of the particles with reference to each other. This idea of structure, as produced by a polar force, leads us to our next subject of enquiry—the action of crystals upon light. First, of

CRYSTALINE ARCHITECTURE.

Crystals are put together according to law. They split in certain directions before a knife edge, exposing smooth and shiny surfaces which are called planes of cleavage, and by following these planes we sometimes reach an internal form disguised beneath the external form of the crystal. We cannot help asking ourselves how they are built. Familiar as we are with the polar force and its ability to produce structural arrangement, the answer will be that these crystals are due to the play of polar forces, with which their ultimate molecules are endowed, and upon which their visible form depends. Large crystals are formed with deliberation. Thus a saturated solution of niter just deposits a minute crystal, which afterwards grows, augmented by molecules, from the surrounding liquid until we have large prisms of the salt of perfectly definite shape. Alum also crystalizes with the utmost ease after this fashion. If the crystalization be too sudden, the regularity disappears.

SUSPENDED CRYSTALIZATION.

Water may be saturated, when hot, with sulphate of soda. When the liquid is cooled it is supersaturated, yet the molecules will not crystalize. Each molecule wishes to unite with both of its neighbors on either side; one tendency neutralizes the other and it unites with neither. But if a single crystal of sulphate of soda be dropped in, its adjacent molecules will precipitate themselves, and others will follow, until the whole solution, as far as possible, is solid. But the crystals are small and confusedly arranged because the process has been too hasty to admit of the orderly action of the crystalizing force. The

FORMATION OF CRYSTALS

was exquisitely illustrated by pouring over a glass plate a solution of chloride of ammonium. Setting the glass on edge to allow the liquid to drain, a thick film was obtained, the evaporation of which was promoted by slightly warming the plate. The glass was then placed in a solar microscope. Reflected upon the screen appeared the most beautiful crystals, forming themselves with extraordinary rapidity. A somewhat similar effect may be produced by breathing on a pane of glass during cold weather, and observing the formation of the frost crystals with a lens.

A second illustration was the placing of thin platinum wires from a small voltaic battery in a solution of sugar of lead. As soon as the current began to pass, the metal was liberated by electrolysis, and attached itself in exquisite crystals to the end of one of the wires. Then the poles were reversed and the tree of metal already formed seemed to dissolve and was built up on the other wire.

ICE AND SNOW CRYSTALS

were then explained. An inflexible power bends spears and spiculæ to the angle of 60°. We may sometimes see in freezing water small crystals of stellar shapes, each star consisting of six rays with this angle of 60° between every two of them. The

REFRACTION OCCASIONED BY DIFFERENCE OF DENSITY,

according to the undulatory theory, was illustrated by the Professor holding a long rod in a horizontal position and asking the audience to consider it a wave of light coming plump downward from a star. Supposing the platform to be transparent, this wave might be expected to pass through it without change of direction. He then held the rod at an angle of 45° to the floor, and, supposing the rod a wave, showed clearly that if on entering the material of the platform it encountered a denser medium, the lower end of the rod would be somewhat retarded before the upper end reached the surface of the platform. This would change the front of the wave and consequently its direction. This change constitutes the refraction of light and is evidently proportionate to the density of the transparent body. Now, in virtue of the crystaline architecture that we have been considering, the ether, which surrounds the atoms of all bodies, in many crystals possesses different densities in different directions, and the consequence is that some of these media transmit light in two different velocities. But refraction depends wholly upon the change of velocity being greatest when the density is greatest. Hence in many crystals we have two different refractions, a ray of light being divided by such crystals into two. This effect is called double refraction.

ORDINARY AND EXTRAORDINARY POLARIZED RAYS.

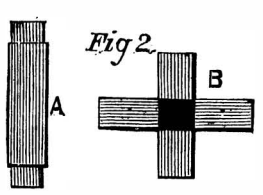
Double refraction is displayed very strongly in Iceland spar, which is crystalized carbonate of lime. Placing a piece of this substance in the electric lamp, Professor Tyndall caused two images of the carbon points produced by the divided rays to appear. They were then concentrated by lenses into two bright spots of light. When the crystal of spar was rotated, one spot became a center around which the other one revolved. One beam obeys the ordinary law of refraction, discovered by Snell, and is called the ordinary ray. The other does not; its index of refraction, for example, is not constant, nor do the incident and refracted rays lie in the same plane. It is, therefore, called the extraordinary ray. In the bright spots on the screen, the most strongly refracted, is, in this case, the ordinary ray. Turning the spar around, the extraordinary image is the one that rotates.

ORIGIN OF THE TERM "POLARIZATION."

It has already been explained that the vibrations of individual ether particles are executed across the line of propagation. In ordinary light, we are to figure the ether particles vibrating in all directions across this line. In a plate of tourmaline, cut parallel to the axes of the crystal, the beam of incident light is divided into two, one vibrating parallel to the axis of the crystal, the other at right angles. One of these beams, namely that one whose vibrations are perpendicular to the axis, is quenched with exceeding rapidity by the crystal, so that, after having passed through a very small thickness of crystal, the light emerges with all its vibrations reduced to the same plane. This is what we call a beam of plane polarized light. The fact that

POLARIZED RAYS ARE QUENCHED WHEN CROSSING AT RIGHT ANGLES

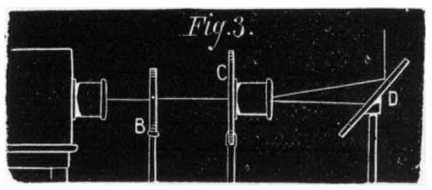
was exhibited by throwing the image of a plate of tourmaline upon the screen. Placing parallel to it another plate, the two gave green images, as at A, Fig. 2. These images



gradually darkened as the plates were rotated until, when at right angles, the center was utterly black, B. On continuing the rotation, they gradually recovered color and transparency. Professor Tyndall then reflected the green images in various directions. When the image was horizontal, on being reflected upward it still remained green; on being reflected sideways, it was quenched, because of the incompetency of the green light to be reflected in that direction. In one case, the mirror receives the compact of the edges of the waves, and the light is quenched: in the other, the sides of the waves strike the mirror, and the green light is reflected.

POLARIZATION BY REFLECTION.

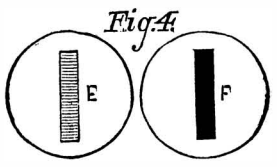
The quality of two-sidedness conferred upon light by Iceland spar may also be conferred upon it by ordinary reflection. If we hold a piece of window glass so that the beam shall make an angle of 56° with the perpendicular to the glass, the whole of the reflected beam is polarized. This is called the polarizing angle. B, Fig. 3, is a lens. C con-



tains Iceland spar, by which all the vibrations of ordinary length are reduced to two planes, right angled to each other. But unlike tourmaline, this spar transmits both beams with equal facility. When, therefore, the light is polarized by reflection, the direction of vibration in the spar which corresponds to the direction of vibration of the polarized beam transmits it, and in that direction only. Consequently, from the two rays which proceed to the glass, D, but one image is possible.

BLACK OR GREEN IMAGES OF TOURMALINE.

Professor Tyndall next threw on the screen two disks of light produced by the double refraction of the spar, E and F, Fig. 4. He then placed before the crystal a plate of



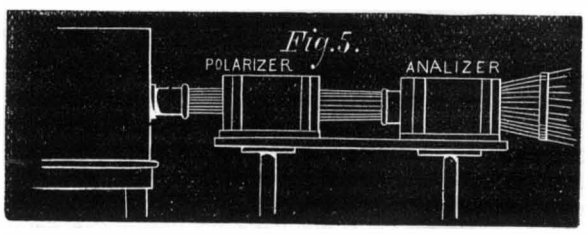
tourmaline, the light emergent from which, he said, was polarized. The spar has two perpendicular directions of vibration, one vertical, the other horizontal. Now when the green light should be transmitted along the latter, which is parallel to the tourmaline, and not along the former which is perpendicular to it, the light in the circles, as represented in the diagram, was white. In the middle of each the strip of tourmaline was represented, in one by a green, in the other by a black, image. The tourmaline was rotated on its center, and when the two images formed a horizontal line, they both appeared of a darkened green. When still further rotated, the images entirely interchanged colors.

MICA TURNS DARKNESS INTO LIGHT.

When the plates of tourmaline were crossed, the intersected spaces were black, but the least obliquity of the crystals allows light to pass through. If we introduce a third plate of tourmaline obliquely, it will abolish the darkness. Having no tourmaline, Professor Tyndall introduced a film of mica between the crossed plates. The effect was almost magical, the darkness being apparently pushed away by the edge of the mica.

THE NICOL PRISM.

We have seen the two beams emergent from Iceland spar and have proved them to be polarized. It is possible that one of these rays may be totally reflected and the other not. An optician named Nicol cut a crystal of Iceland spar in two in a certain direction. He polished the severed surfaces and reunited them with Canada balsam, the surface of union being so inclined to the beam traversing the spar that the ordinary ray which is the most highly refracted was totally reflected by the balsam, while the extraordinary ray was permitted to pass on. Professor Tyndall then explained the apparatus sketched in Fig. 5, in which were two Nicol



prisms. Placed with their directions crossed the light is quenched; on introducing a film of mica between light is received. But we also obtain colored light. Taking a thin splinter of selenite, the lecturer placed it between the prisms, when the image on the screen showed the most magnificent tints. Turning the prism in front, these colors gradually faded and disappeared, but, by continuing the rotation until the vibrating sections of the prism were parallel, vivid hues, complementary to the former ones, appeared.

Placing some films, shaped to represent flowers, between the prisms, by turning the front Nicol 90° around, a red flower and green leaves were shown; rotating it another 90°, a green flower with red leaves appeared. Other beautiful chromatic experiments of similar nature were introduced, which Professor Tyndall said could all be explained by the principle of interference, and he promised to develope the causes in his next lecture.

© 1873 SCIENTIFIC AMERICAN, INC.

Correspondence.

The Universal Caravan.

To the Editor of the Scientific American:

My learned friend, the Abbé Moigno, has called my attention to an article on the "Universal Caravan" which appeared in your valuable paper of November 23. I beg to offer my compliments for it to your humorous contributor, and, without taking the least offence at its raillery, which I believe to be well intentioned, I am anxious to set his mind at ease upon one or two points upon which he has incidentally touched.

"How," asks your contributor, "can frequent telegraphic communication be possibly kept up between the caravan, wherever it may be, and Europe? and why are certain States mentioned as calculated to furnish, on their territory, any native troops to the expedition?"

In the States of Asia and several of South America, where the country is devoid of roads practicable for carriages or mule trains, the dispatch service between villages, settlements, and often even between populous towns, is performed by means of native foot postmen, who run for three successive hours at an average speed of six miles an hour. On arrival at the relay station, the package is transferred to a second runner, who goes over his eighteen miles, and so on; so that parcels weighing twelve or fourteen pounds can traverse 144 miles in 24 hours. Suppose, for instance, that the caravan happens to be in the western part of the Province of the Amazons, belonging to the Republic of Equador, at about 200 miles from Riobamba, that is to say, at about ten stages or thirty-four hours from this town, whence a courier starts every day for Guayaquil, which he reaches in thirty-six hours. Our letters are then delivered to an agent of the Havas agency, appointed for this special duty. This agent condenses into the smallest possible number of words and transmits to the nearest telegraphic station all special information respecting the members of the caravan. Transfer the same system into the stony desert of Australia, now telegraphically connected with the European and North American systems of wires, and you will understand how the problem is solved.

I more specially mentioned certain States or colonies (without indicating all of them) in which communication is the most imperfect when travelling alone and without any recognized political or scientific mission. In these States, I have met with aid and protection from the authorities, which has been carried so far that I have been gratuitously accompanied by a certain number of native troops, who were of the utmost assistance to me in the forest.

Although the caravan has an object within the limits of human possibility, and has no encyclopædic pretensions, I am anxious to explain, by one striking example, the practical and immediate services which it may render to science.

Quinine was imported into Europe sixty years before its admission into the pharmacopœias. I will not now inquire why science remained so long deprived of the most efficacious remedy for fever at its disposal. Whenever the natives of the region I am traversing shall point out to me, as an efficacious remedy against such and such a disease, a plant, root or leaf, I will cause this object to be sought for under the inspection of the botanist and surgeon, and will have it submitted to a chemical analysis before its elements have undergone the changes from desiccation or moldiness inseparable from a long sea voyage. If this operation reveals the presence of a chemical principle, an essence, or an alkaloid, explaining the curative virtues attributed to the plant by the natives, I will forward, to the schools of medicine and to the scientific journals, the wood, bark, or root, and the analysis, botanical classification and observations made during the processes carried on under our eyes. By this means, I hope to avoid delays in the admission, by medical men, of new efficacious remedies of which we are now deprived, and they are many, and further to prevent the disgraceful speculations on the credulity of invalids which prevail everywhere.

My itinerary does not contemplate crossing Central Africa, where, thanks to the efforts of the distinguished Livingstone and the recent voyage of your brave fellow countryman, Mr. Stanley, we may easily foresee that civilization will soon necessitate a political action which only a great nation could undertake. The perimeter of the African continent will furnish a field vast enough for the studies we have undertaken.

Finally, independently of ethnography, written impartially and without any prejudiced criticism of races, the Universal Caravan purposes to create a new science, namely, the art of enabling to travel advantageously, almost without danger and without great privations, a group of men of different nationalities, whose objects call for the good will and protection of civilized nations. BAZERQUE,

12 Boulevard des Capucines, Paris. Captain.

The Bar at the Mouth of the Mississippi.

To the Editor of the Scientific American:

The bar at the mouth of the Mississippi is, as we all know, one of the greatest drawbacks to the commerce of the West that there is, and many plans have been advanced to obviate that trouble, among others, that of digging a canal from the Gulf to the river, some miles above its present mouth.

Vessels of a large size cannot load to their full capacity and cross the bar; indeed they can hardly carry half a cargo. Now if it were so that large steamers could carry a full load, they could take freights cheaper; and, taking freights cheaper, they would cause most of the European shipments to be sent by way of New Orleans, particularly the grain and cotton. Indeed, I think three fourths of the grain and all the cotton shipped to Europe would follow this channel, and thus add much to the prosperity of the South.

To build a canal at the mouth of the Mississippi would cost many millions of dollars; the amount indeed would be incalculable, as it would be more troublesome to keep a sufficient depth of water in it than it is in the Suez canal; for instead of the shifting sands of the desert, we should have to contend with what is worse, the shifting mud of the Mississippi, which has already caused the bar at the mouth; and three of the most expensive dredge boats in the country can hardly keep a channel of fourteen feet depth of water on this bar. And it would be the same in a canal; for as soon as the sediment in the river meets the dead water of the Gulf, it will settle there and form another bar, which no number of dredge boats could clear away as long as the "Father of Waters" empties into the Gulf of Mexico.

The only way that this difficulty can be overcome is by some sort of "marine camel." Instead of trying to dig the bar away, lift vessels over it, which, costing comparatively little, would do everything required of a canal. Let the inventors of the country give us their plans for a "camel."

C. W. STEWART.

Memphis, Tenn.

Steam Pressure on Boilers.

To the Editor of the Scientific American:

Which is the right way? Must we multiply together the pressure and circumference, the pressure and half of the circumference, the pressure and diameter, or the pressure and half of the diameter, for the true answer? I believe that each of these methods has been held to be the true one, by men who certainly write as though they ought to know what they are talking about.

A boiler 100 inches in circumference, sustaining a pressure of 100 pounds to each square inch, would have upon each circle of the boiler of one inch wide, according to the first method, 10,000 lbs., according to the second, 5,000 lbs., according to the third, 3,200 lbs., according to the fourth, 1,600 lbs. This is a serious discrepancy.

If two men, each with spring balance in hand attached to a cord, should test the strength of the cord by pulling against each other till each of the spring balances indicated 100 lbs., would it be held that the cord sustained 200 lbs.? It is, of course, clear that there can be no strain in one direction without an equal resistance or strain in the opposite direction, whether the object tested be a steam boiler or a cord; hence, I consider that the semi-circumference method is the true one.

The breaking point of a strip of good boiler iron, one inch wide and one fourth of an inch thick, is about 13,000 lbs. It is well known that a well made boiler of such iron, 32 inches in diameter, will work safely at 150 lbs. to the square inch, which would be 200 lbs. above the bursting pressure, if the whole circumference method were the true one. On the other hand, if the semi-diameter method were the true one, 150 lbs. to the square inch would be but about one fifth of the bursting pressure.

It seems to me that all of our practical dealing with steam boilers agrees with the semi-circumference method.

Worcester, Mass. F. G. W.

REMARKS BY THE EDITOR.—It is a well known principle in hydraulics and pneumatics that the pressure of a fluid on the internal surface of any vessel is exerted in any given direction with a total effect which is measured by the product of the intensity of the pressure by the projection area of that surface on a plane at right angles to the direction assumed. To determine the force tending to rupture a cylindrical boiler, multiply the pressure per square inch by the diameter and divide by the thickness of metal which must be ruptured, to obtain the stress per square inch of metal; that is, divide this product by double the thickness of the boiler plate. Or, divide the product, of the pressure per square inch into the radius, by the thickness of the sheet.

Our correspondent, B. F. McKinley, in the SCIENTIFIC AMERICAN of December 21st, 1872, gave a correct statement.

Steam Statistics.

To the Editor of the Scientific American:

The following figures relating to steam may be useful:

One cubic foot of water weighing 62·5 pounds, converted into steam of one atmosphere, gives a volume of 1,728 cubic feet of steam. If 62·5 pounds give 1,728 feet, then one pound gives $\frac{1728}{62.5}$=27·67 cubic feet.

A displacement of 27·67 cubic feet is made by one square foot,=144 square inches, traveling a distance of 27·67 feet lineal. Now, a pressure of one atmosphere, 14·7 pounds, on a surface of 144 square inches, through 27·67 feet gives a result of 27·67×144×14·7=58,572 foot pounds; this divided by 772, the number of foot pounds equivalent to one degree of heat Fahr., gives $\frac{58572}{772}$=75·87 degrees of heat represented.

It appears to be a very singular fact that if one half of this 75·87,=37·93, be added to 212°, the temperature of one atmosphere, we have 212°+37·93°=249·93°, the temperature of two atmospheres.

Add to this $\frac{1}{3}$ of the same, $\frac{75.87}{3}$=25·290, and we have 249·93+25·290=275·22, the temperature of three atmospheres, and so on. If we add together the fractions $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}=\frac{87}{60}=1\frac{27}{60}$, and multiply this by 75·87, we have $75{\cdot}87\times1\frac{27}{60}=110°$; this added to 212° equals 322°, the temperature at six atmospheres. Thus it seems that the fractions above denote the rate of increased temperature as the pressures pass through that of the number expressed by the denominator of the last fraction used.

Is there any known mathematical analysis of the relations of heat, pressure and volume of steam? If so, what is it?

B. F. MCKINLEY.

Insensibility---When Complete.

To the Editor of the Scientific American:

Much has been written upon the question whether pain follows, or intelligence remains, after decapitation. As positive proof is impossible, unless spiritualism be true, one man's opinions are likely to be worth about as much as another's. Facts, in the history of living persons, throw light on every subject, and, I think, on this.

The stoppage of the breath from any cause is immediately followed by insensibility, both of body and mind. This is susceptible of daily proof. The victim of foul gas in wells falls insensible. This is why so few are rescued in such cases. Any one choked sufficiently to stop the breath immediately becomes insensible. I may be asked how do I know this? I learned it, when a boy, in this manner.

In sport, one evening after school, I drew my "comforter" tight around my neck, and a "big boy," to further the sport, drew it tighter, when I dropped insensible as quickly as if struck by lightning. The comforter was loosened and I immediately recovered and felt no inconvenience resulting. This to me has always been a proof of the foregoing assertions. No one can suppose that consciousness would have returned without returning breath. I have often wondered where the immortal part of me was during that brief period. The barbarous practice of neck-breaking, under the pretense of hanging, to produce death, is sometimes talked of as quickening one's journey to the other world and making the passage painless. It makes it sure, but, in my opinion no less painful, as in either case, if strangulation is complete, there is entire exemption from pain and entire insensibility. The motions of the hanging man are entirely involuntary, and are no indication of pain felt any more than are the contortions of one in a spasm. I have known a child, badly burned on the feet with a hot brick during a spasm, to have no consciousness of it at the time or recollection of it afterwards. The humanitarian, who only desires an execution for the benefit of society and a neck broken for the benefit of the party directly interested, would accomplish his end as well, and the end of he person as effectually, by simple strangulation, as by a six foot drop and a broken neck.

E. H. R.

The Prevention of Fires.

To the Editor of the Scientific American:

In view of the terrible destruction of life and property by fires in our cities, it is surprising that more pains is not taken to prevent such disasters. One of the simplest of all means is to have a stand pipe connected with the service pipe from the city mains carried up through the building to the top, and provided on each floor with a cock, to which a hose can be instantly attached, in case of need. In hotels and factories, there should be a hose for each floor, and it should always be connected, so that the turning of a cock would supply the water at once. The pipe should be located in a hall, or some place from which a hose could be laid to any of the rooms on each floor—the hose, of course, being long enough to reach any room, and being provided with a nozzle and stop-cock like those used for street washing. I have such an arrangement in my own house, and would never think of building one without it, where water could be obtained. In those cases where there is no water supply, or where it will not rise to the top of the building, a cistern should be located as high as possible and receive the water from the roof, or it might be supplied with a force pump, operated by a windmill or other power.

Such an arrangement, with a hose, I consider far better than the plan which has been suggested, both recently and years ago, of placing all through the building perforated pipes for flooding it with water in case of a fire: because with a hose, the water can be thrown just where it is needed, while in the other case it will fall only at certain fixed points, and would flood the house in parts remote from the fire. A net work of perforated pipes in a factory or large building might answer; but as a general thing, the other plan will be found far more practical and much cheaper. Some such safeguard ought to be required by law in every building where it is possible. W. C. DODGE.

Washington, D. C.

REMARKS.—The method suggested by our correspondent is excellent, and has long been in use in large buildings in New York and other cities. This plan is employed at the Fifth Avenue Hotel in this city, and its excellence was demonstrated during the recent fire in that building. In thirty seconds after the fire was discovered, the hose was stretched and the water was playing upon the fire.

Aniline Inks.

To the Editor of the Scientific American:

An article in a late number of the SCIENTIFIC AMERICAN appears likely to induce a great use of aniline inks. It, however, ought to be known that, as a rule, these inks are the least permanent of any in common use. Still, further, in view of recent great conflagrations, it is to be noted that no inks have been so generally destroyed, where used on books or paper subsequently charred in fireproof (?) safes, as the various aniline inks. A very extensive experience in restoring charred paper in the Chicago, and now in the Boston, fire has convinced me that these inks, as a class, are beyond the power of the chemist to restore to legibility when exposed to a high temperature.

Boston, Mass. C. GILBERT WHEELER.

By relying on our own resources we acquire mental strength; but when we lean on others for support, we are like an invalid who, having accustomed himself to a crutch, finds it difficult to walk without one.

© 1873 SCIENTIFIC AMERICAN, INC.

GLEANINGS IN SCIENCE AND ART.

Regeneration of Limbs.

If a lobster's claw is broken off below the third joint, another will soon appear in miniature at the end of the stump. About the third year it will overtake in size the one on the other side. This explains why the pugnacious creatures are so frequently noticeable with one large and one very small pair of fighting shears.

At a particular season, the males engage in ferocious combats, cutting each other in pieces if they can. Nipping off the sword arm of an opponent is a point of sanguinary ambition. They quarrel worse than a congregation of tailors on a strike.

When, by accident or otherwise, a Brazilian lizard's tail is missing, another crops out immediately, requiring considerable time, however, to develop into full proportions. It is to them as indispensable an appendage as a balancing pole in the hands of a rope dancer, in maintaining their centers of gravity while racing through the top of a tree in pursuit of prey. Could a fox run without a tail? But a second one never grows, so he is crippled for life when that is gone.

Some of the newts have a new eye generated, if gouged out, which will ultimately exactly correspond with the old one in color, function and visual perfection.

All the mammalia, including ourselves, have something of that remarkable regenerating property—particularly exhibited in the re-union of broken bones, which shows a graduated relationship to the lower forms, even to reptile life. Such are the deductions of science, unwilling as some may be to embrace the doctrine of evolution.

Pulmonary Consumption.

An admirably written volume was published not long since by Longmans & Co., London, on that destructive malady which almost defies medical treatment in its amelioration. Dr. Henry MacCormac, of Belfast, Ireland, is the author. Were it republished here, it would lead to reforms in regard to preventing a disease which is often actually induced by violations of the laws of health. Consumption is mowing down the young and the promising before they are prepared for the responsibilities of life. There are two forms of consumption, namely: that which is hereditary, being transmitted from parents to their children, and that which is induced. The latter is the main topic discussed by Dr. MacCormac, which, he is persuaded, has its origin in re-breathing expired air. Those of a delicate organization should sleep alone, and if possible in spacious rooms. That would insure a larger supply of pure, uncontaminated air. On retiring, never omit raising the window sash slightly. When the dormitory is small, if not carefully ventilated, oxygen, the essential element that supports life, is quickly exhausted, and the individual takes back into the lungs carbonic acid gas, which destroys life. Thus the whole system becomes deranged, the air cells ulcerate, and, with the destruction of those, the whole bronchial region falls into disease.

Fresh atmospheric air was intended to be inhaled. It is the source of vitality; therefore, be in no apprehension from exposure to its influences. When the air is charged with excessive humidity, avoid unnecessary exposure; but clear weather, a bright sun and airy sleeping rooms promote health and longevity.

Borax.

Besides having many uses in the arts, borax is an antiseptic. M. Jacquez has been before the French Academy of Sciences with an elaborate paper. The sub-borate of ammonia, too, according to the results of that gentleman's experiments, is of marked importance to the world of science.

A solution of five parts of borax in one hundred of water is represented to prevent the putrefactive process in meats for considerable time. Flesh dipped in the mixture and then dried resists the usual processes of decomposition.

For dissecting rooms, the taxidermist and those engaged in preparing cabinet specimens of animal tissues, the announcement of M. Jacquez should command attention on the score of economy if on no other account, it being no way dangerous or liable to involve assistants in painful accidents, not unfrequent with arsenic, which is commonly employed in modern embalming and in securing anatomical preparations against the depredations of vermin.

Vital Mechanism.

It has been assumed by those competent to form an opinion that there are twenty-five thousand muscles in a silkworm. There are eight thousand in the trunk of an elephant, and in most of the serpents perhaps more than a million. Through the instrumentality of those organs the flexibility of the boa constrictor depends. By an act of will—that is, instantly charging the muscles with an extra force—the great python of Africa crushes a living lion into a shapeless mass for swallowing. Every bone is ground into fragments, so that no opposing obstacles in the form of splinters or projecting points can injure the throat on the way to the snake's immensely large elastic stomach. Neither art or science has yet discovered a method for generating such power by apparently such a simple device.

Musical Sounds.

The longest and largest pipe of the great Harlem organ, thirty-six feet in length, when sounded, actually jars the whole edifice. If there are less than thirty-two vibrations in a second, it is a noise analogous to the flapping of the wings of a huge bird. The human ear recognizes no music in that. All vibrations above thirty-two are musical, till they reach thirty thousand in a second.

Such is the perfection of our auditory sense that the mind is excited, charmed and exalted by acoustic undulations which are transmitted to the brain through a small, soft cord, scarcely larger than a single silk thread.

Reflecting on the laws of sound, the extreme delicacy of the mechanism by which it is received, transmitted and analyzed in a moment of time, who can doubt the existence of a Divinity whose works, independent of moral attributes, are self-evident propositions.

Guinea Pigs.

A writer of distinction says those little, plump, clean animals should be used for food. A mistaken notion is entertained generally that they are a kind of rat, and therefore an unjust prejudice ought to be overcome, since they are excellent eating. Guinea pigs are not pigs. They are harmless, timid, vegetable feeders. Their flesh is nutritious and delicate. If once received into our markets, being easily raised, they would soon be prized for their many desirable dietetic properties. Being prolific, too, they might be raised in vast abundance, their food being an item of no expense, a few cabbage leaves, roots or waste parings being all they would require to grow into proportions to fill vacancies in a gourmand's stomach.

Electric Cautery in Surgery.

Surely the world is moving. One of the last and perhaps greatest improvements in surgery is a new method of cutting away formidable tumors in some of the cavities by electricity. Where it is almost impossible to secure bleeding vessels on account of reaching them, for example in detaching a fungous growth far off in the nasal cavities, throat, etc., a wire is passed round the base, the battery set in motion, and, *presto*, the tumor is separated without loss of blood, the vessels being seared as it were with a hot iron. Better still, under the lulling effects of chloroform or ether, the patient experiences neither pain nor loss of strength from hœmorrhage.

Fatal Flybites.

Deaths very frequently occur from slight punctures made by flies in warm climates. Occasionally such cases occur in temperate zones, but the cause of such a melancholy result from a slight wound in the skin does not seem sufficient to produce excessive swelling, pain, discoloration and other extraordinary appearances which are quickly exhibited. It is, therefore, possible that the insect which makes the tiny wound has its proboscis charged with an active poison from some source where it had recently been foraging, which, introduced into a bleeding wound and rapidly carried by the absorbents into the system, is followed by death.

Observation on those forms of ophthalmia so common in Egypt, ending in blindness of one if not of both eyes, leads to the opinion that the dreadful malady is propagated by flies, carrying, on their feet and feeding tubes, purulent matter from diseased organs whence they are kept away with difficulty, to sound ones, where they are attracted by moisture on the margin of the lids.

Rapidity of Muscular Contractions.

A dragon fly balanced on its wings at the side of a car speeding its way over the rails, at the rate of forty miles an hour, appears to be almost motionless. But to keep up with the car, its wings must vibrate many thousand times a second. The eye cannot detect their up and down action, so exceedingly rapid are the contractions and relaxations of the muscles acting upon them. All at once they dart off at a right angle so quickly that the retina cannot have an impression remaining long enough to retrace their course. Therefore, those same muscles, too small to be seen but by powerful microscopic assistance, must be urged to still more rapid action. Such intense activity far exceeds the vibration of musical chords, and therefore exceedingly perplexes entomologists, because the nervous system of insects is so extremely minute. The question is: How much power is generated for keeping a dragon fly's wings in uninterrupted motion for many hours in succession without apparent fatigue?

Transplantation of Trees and Shrubs.

Vegetable life depends as much on vital functions for its preservation as animal life. But the way trees are treated ordinarily, in their removals from location to another, indicates a very limited knowledge of physiological laws.

Plants repose at night like higher organizations, waking in in the sunlight of morning, invigorated and refreshed. Through the long, tedious months of winter, they sleep profoundly. While the leaves are green and vigorously performing a series of labors, preparations are made for a coming season of cold, ice, snow and other influences which reduce the vital force to the lowest point without destroying it. That is the best time in the life of a tree for transplanting it. That business is admirably managed in France. They don't think of waiting for a mere stick to grow into a broad, spreading tree. No, they select splendidly developed trees, with waving branches, and place them where their grand appearance will be admired.

In the squares of New York, the Park Commissioners are now pursuing the proper and only promising plan of success by bringing in from the country well grown trees, dug up out of the frozen ground, with all the roots covered with two or three feet of the earth in which they grew. Being set out in their new positions, the cardinal bearings being the same, in the spring they will rouse up like refreshed laborers, and bud and blossom as they did before. That is the true system. It may be accomplished at any period if the roots are never injured or exposed but clothed, thickly and securely, with their own attached soil. Never cut off a limb or a twig till they have a secure foothold. Leaves are the breathing organs of trees. Most persons make a fatal mistake in trimming trees when transplanted. They die because they cannot breathe, oxygen being thrown off and carbon absorbed from the atmosphere.

Phosphorus in Medicine.

Besides being extensively used in making matches, astonishing audiences when legerdemain performers blow fire from their mouths, and a prominent source of surprise in chemical laboratories, the physicians are prescribing it. One hundredth of a grain is secured in suet, supposed to be a fireproof covering; thus secured, the dangerous enemy is swallowed. According to the testimony of enfeebled notabilities, these fireballs, small as they are, made them feel as lively as political candidates for office. No patent medicine can be successfully introduced till endorsed by the clergy, say the proprietors. It remains to be seen whether medical practitioners of eminence, those who are conscientious laborers in the vineyard of humanity, will sanction the phosphoric practice, even if fortified by certificates from lame, halt and blind, whose imaginations, as often as otherwise, run away with their judgments. Happily they are not patented.

Life and Matter.

Nothing remains at rest. If a single particle in a living body were quiescent, a chain of disastrous consequences would quickly follow, terminating in death. Such is the fact respecting the necrosis of any part of an injured bone. When the circulation and deposition of new ossific materials is interrupted at any particular point or region, mortification, gangrene and a throwing off of the dead portion immediately commences.

We are perpetually supplying the system with new life material. That is accomplished by food in the stomach. It is there put in a condition to be wafted all through the body. On its route a particle is dropped here and there, and at the same instant an old one is removed. As soon as the vitality of the new piece has been imparted, it becomes from that instant useless. Thus we are perpetually being renewed, and by eating and drinking the supply is equal to the demand. Thus may be explained a law of the animal economy, how it is that we have neither the same bones nor the same flesh to-day that we had years ago Although identically the same individuals, our bodies have been renewed repeatedly in the course of an ordinary lifetime. Whenever that process of assimilation is interrupted—in other words, when neither new matter is supplied nor the old can be removed, as when in health—death is inevitable.

Therefore, it is self-evident that every particle of nutriment is charged with a definite amount of vitality. An aggregation of these elements eventuates in a life-force. Variously arranged, they result in particular organic forms, and who can say that this may not have an important bearing on the gradation of intelligence from one type to another in the ascending scale of animal forms from creeping things to man?

Catching Wild Ducks.

In the published narrative of a traveller in Arabia, the author saw people catch wild ducks very successfully in the harbor of Jidda, an Oriental city, in the following manner:

An Arab stripped himself and then cautiously waded into the water up to his neck. He then covered his head quietly with seaweed. When properly arranged, he walked off to where the birds were busily employed in swimming about, foraging on the surface. They were not in the least alarmed at the approaching mass, which was evidently regarded as floating weeds. Fairly in amongst them, he reached up and caught them by the legs till satisfied with the number for the occasion, which were thus secured, and then wended his way to the shore with extreme deliberation. Thus the ingenuity of man circumvented the watchful instinct of aquatic animals that are so vigilant for life and liberty as to dive on hearing the click of the lock before an explosion of the charge takes place in the gun.

Casting Metals in Vacuo.

With the ordinary process of casting, the air enclosed in the interior of the molds, not being driven out at the moment when the metal enters, forms between the casting and the mold a very thin envelope, which prevents the metal from taking the exact form of the mold, and which occasions air holes and other defects. These inconveniences are particularly felt in casting works of art, and to avoid them MM. Cumin and Martel, of France, have devised a process recently patented by them. This process is based upon the employment of a vacuum. At the moment of casting the mold is placed in communication with an air pump in such a manner that the air is drawn from the mold through the pores of the material of which it is made. The interior surface of the mold is, therefore, covered with a substance sufficiently porous to allow the air to pass, yet of ample resistance to guarantee perfection in the form of the object cast. The material employed varies with the nature of the metal.

1. For those very easily fused, such as type metal, the inventors employ fine plaster well dried.

2. For harder metals, such as bronze, they use plaster mixed in almost equal proportions with plumbago, alumina, and other substances of a similar nature, this mixture having been previously thoroughly dried, to drive off all the water from the plaster.

3. For more refractory metals, such as cast iron and steel, the sand mold is simply covered with plumbago, or other analogous materials.

THE BATTERY, NEW YORK.—In connection with this favorite New York resort, it may be noted that a new pier is being constructed. The new pier will be 500 ft. long and 80 ft. wide, and it will be supported on 19 arches. These are placed upon foundations of huge blocks of artificial stone.

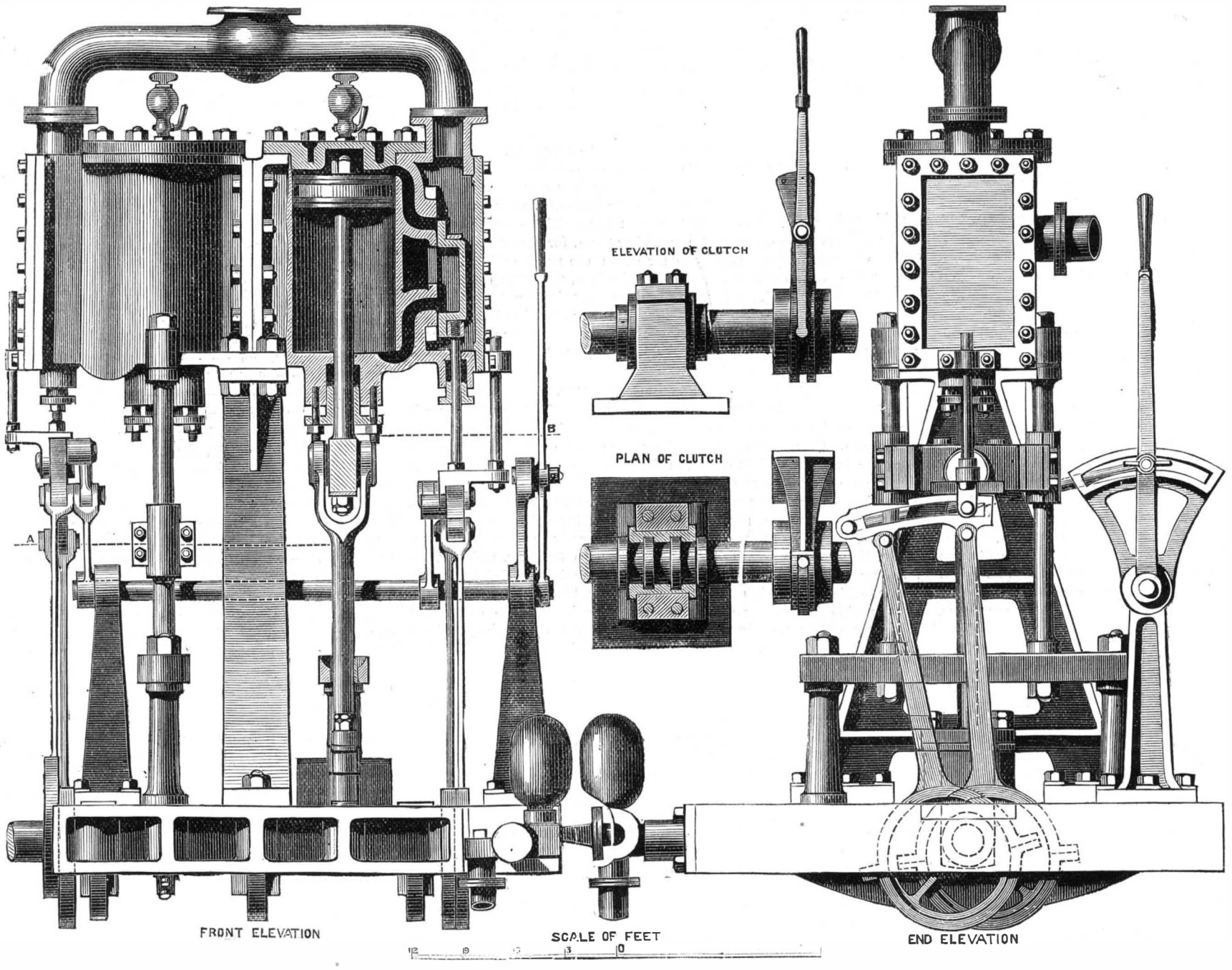
© 1873 SCIENTIFIC AMERICAN, INC.

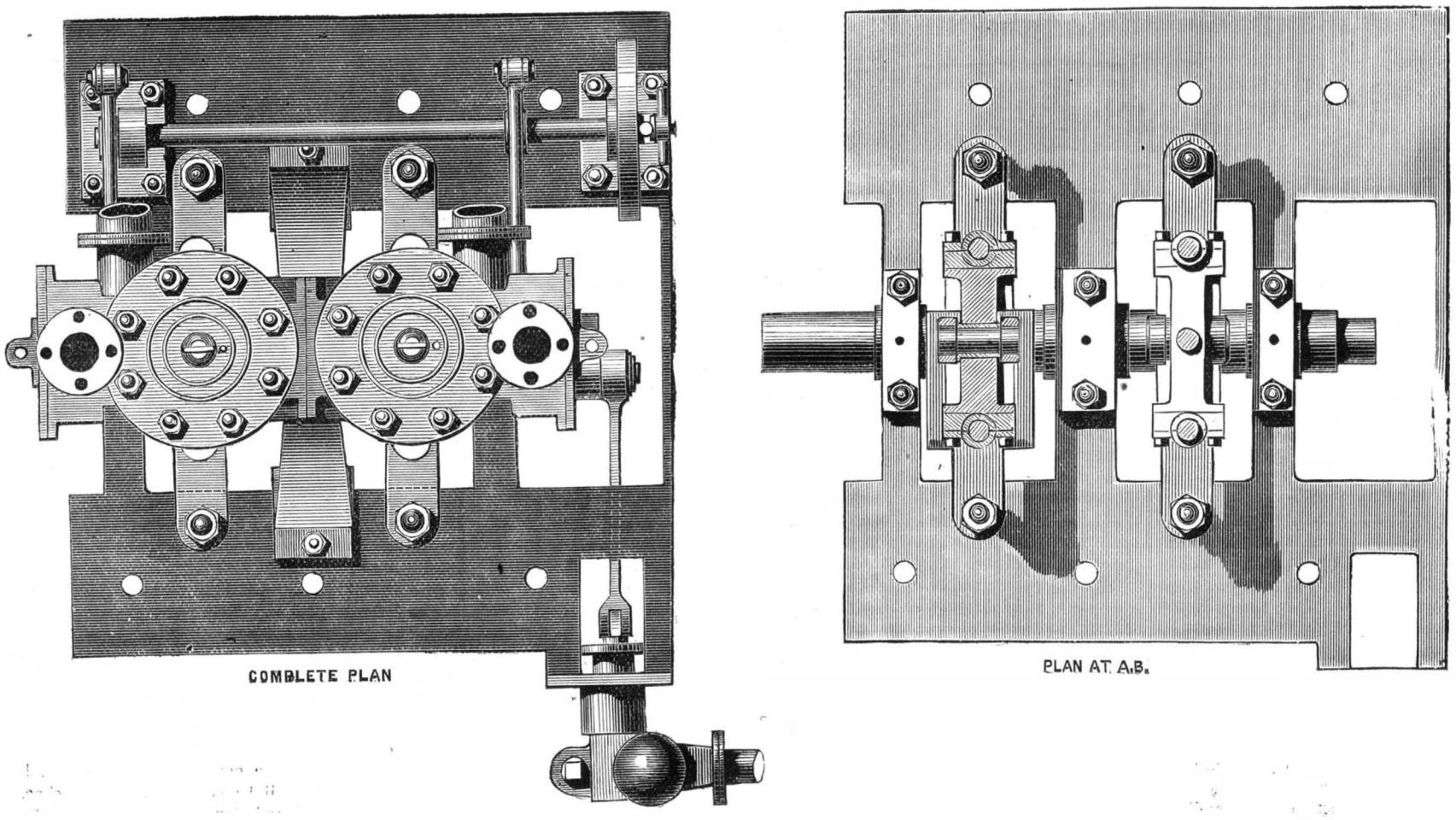
NINE HORSE POWER COMPOUND BOAT ENGINE.

The use of small boats propelled by steam, upon our many inland lakes and rivers, is now so extensive that any improvements in the economy of working, or in the patterns for producing the machinery of such boats, will be interesting to many of our readers. We have therefore engraved, from *The Engineer*, lustrations of a pair of English engines, designed for the purpose mentioned, which, have been found to operate with much satisfaction. These engines are built on the compound plan, and the launch or boat, at Portsmouth, England, in which they are used, is one of the fastest and most economical little crafts that there is afloat.

The engines are of nine horse power, built by A. Verey. The cylinders are of 6 inches diameter and 8 inches stroke. The stroke of the slide valve is 3 inches; the lead, $\frac{1}{8}$ inch, and the lap $\frac{7}{8}$ inch; area of steam ports, 2·65 inches; area of exhaust port, 8·5 inches; diameter of piston rod, $1\frac{1}{8}$ inches; diameter of valve spindle, $\frac{5}{8}$ inch; diameter of crank shaft, $2\frac{5}{8}$ inches; length of connecting rod, 1 foot 6 inches diameter of guide rods, $1\frac{1}{8}$ inches. The engines indicate 24 horse power when working with 60 lbs. steam cut off at five eighths of the stroke and making 300 revolutions per minute.

It will be seen, on referring to the engraving, that wrought iron has been used to an unusual extent in the construction of these engines; by this means space is saved and unusual strength imparted. All the working parts are very easy of access, and the guides and general details are very well designed and proportioned. The engines run at a high speed with great steadiness and absence of noise. The screw shaft is fitted with a disconnecting clutch, by which the engines may be run alone to pump the boiler up, a matter of considerable convenience. We look on these engines as very favorable specimens of the miniature marine engine which has of late become so popular. The boilers used by Mr. Verey are either of the Field type or are horizontal boilers with return tubes.





NINE HORSE POWER COMPOUND STEAM ENGINES.

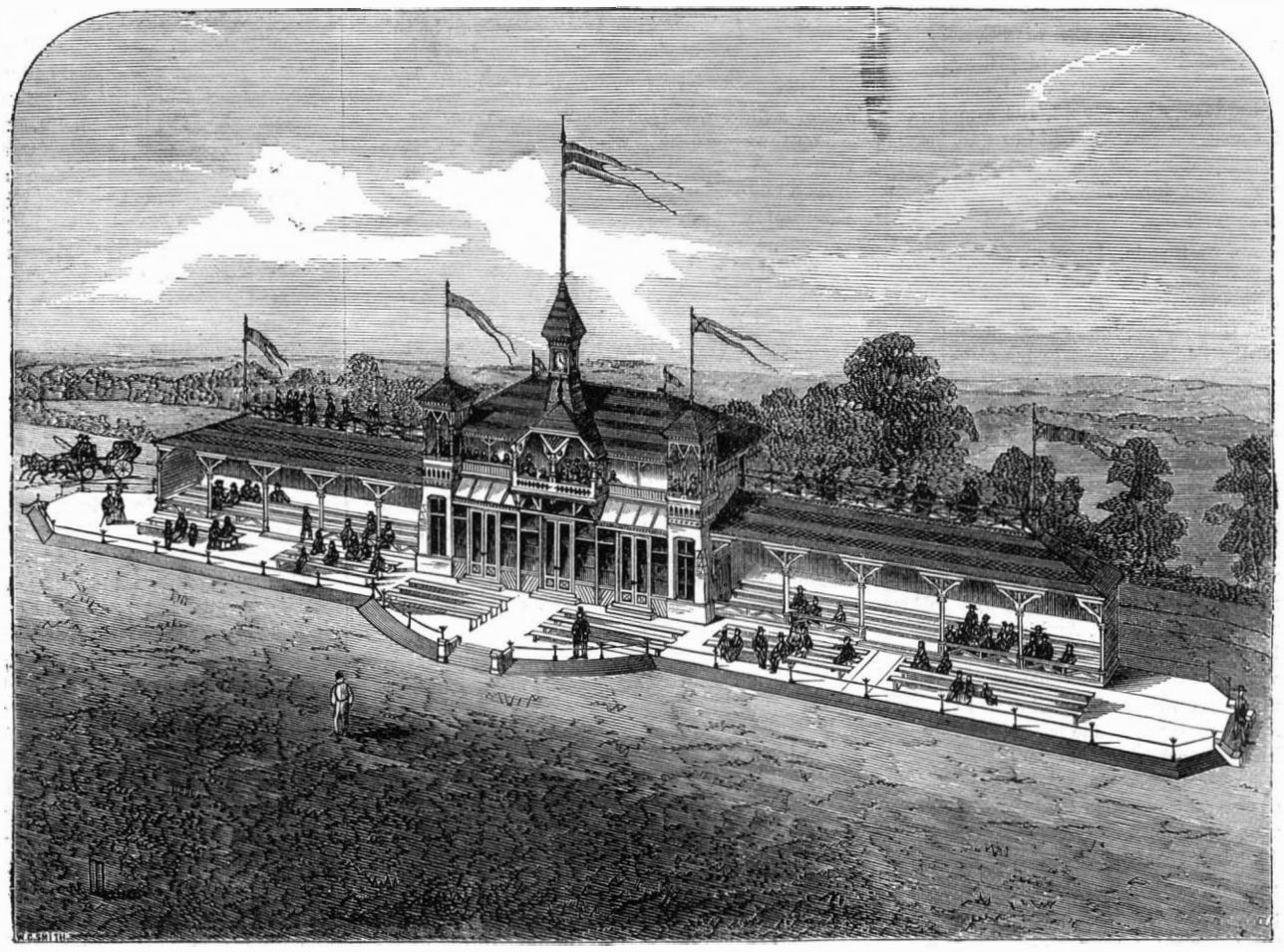
© 1873 SCIENTIFIC AMERICAN, INC.

DESIGN FOR BALL GROUND PAVILION.

The structures which are hastily nailed together and located on the banks of our public skating ponds, especially those of Central Park, can hardly be deemed ornamental, however useful they may be. The same is true of the buildings placed for the accommodation of spectators and others on the borders of our racecourses and ball grounds; all partake of a crudeness of design and, even if intended as permanent edifices, a rough, temporary appearance, which a little architectural skill and a modicum of artistic taste infused in their plans would fully obviate.

We give herewith, taken from the London *Builder*, excellent elevation and plan views of a pavilion to be erected on the large cricket field of Nottingham, England, which, to our mind, is excellently adapted to its purpose. It combines a handsome and finished appearance with the lightness necessary to such structures, and is spacious and commodious without presenting the too common likeness of a poorly decorated cattle shed. The central feature in the design is the pavilion, two stories in hight, the ground floor being arranged for the purposes of dining and refreshment generally. The upper apartment will form a balcony from which a good view of the whole field may be obtained. The covered ways on either side of the pavilion may be used when a match is being played, and serve as excellent shelter from cold wind and rain. The seats in the wings are raised one above another as galleries. The front seats may be removable if required. In the rear are the kitchen and players' dressing rooms. A fine view of the field will also be obtained from the open air galleries over the roofs of side wings, the floor of which will be on a level with the floor of the balcony. The details of the plan explain themselves.

Such a building as this might be advantageously permanently located by the side of the lakes in our Central Park, or in any of the parks in other cities. The necessary accommodations of a boat house might be added, and landing places arranged along the plateau on which it stands. Some of our professional base ball nines, owning their own play grounds, would find it to their benefit to erect some such a structure for the convenience of visitors; or county towns in which fair grounds are situated could employ a similar building for exhibitions, seats for spectators of races, and scores of other uses productive of profit.



DESIGN FOR BALL GROUND PAVILION.

How to Insure Conflagrations.

Run your furnaces to their fullest extent; leave everything to servants and porters, says the Boston *Commercial Bulletin*. The latter, in charge of boilers, engines and furnaces, have only to "fix the draft" and go to sleep. Of course, there is no need of any watchman; a boiler or engine, or in fact any apparatus, ought to run itself after being "fixed for the night."

It makes it all right to have the newspapers say, after a block of buildings have been burned down, that the "fire took in the boiler room," or the engine room, or use that convenient paragraph "probably from a defective flue." The questions ought to arise: Who was in the boiler room? Why did it take in the engine room? Who was on duty?

Boiler rooms and engine rooms can be made, in experienced hands, as safe as kitchen fire places, and we are inclined to the belief that a large proportion of the recent fires are due to the neglect of those whose duty it was to have prevented the possibility of their occurrence.

More vigorous care ought also to be used in merchants' stores and private dwellings. Employees and servants seem to have an idea that a furnace, stove, or fireplace, that they have tended all day, will take care of itself while they sleep, and the latter, to ensure themselves against the discomfort of rebuilding fires in the morning, pile on fuel and arrange drafts at night to ensure combustion, and retire with the utmost confidence for the next six or eight hours. That there are not more fires is due more to the strength of heating apparatus than the care of those who run it.

A VALUED subscriber, in sending in the renewal of his own subscription with twenty new subscribers, says: "While I survive, there are only two circumstances that will prevent me from taking the SCIENTIFIC AMERICAN, namely, poverty and blindness."

Turkey Tobacco.

The famous tobacco of Turkey is cultivated in the following manner: The tobacco seed is usually sown about the middle of March, in small beds, and in a few weeks appears thick, like our lettuce beds; then begins the occupation of the farmer's wife or wives, as the case may be, and their numerous children, whose little fingers are engaged day by day in thinning the beds, care being taken to leave the most healthy looking plants. The husband is engaged either in carrying water from the nearest well by the aid of his mule, or in preparing the land for the reception of the plants. The beds are well watered before sunrise and after sundown. When the young plants are about six inches in hight, they are removed from the small beds and planted in fields, like cabbages in this country, and are then left for nature to develope them to a hight of from three to four feet; three leaves, however, are removed from each plant to assist its growth. The farmers calculate always fifty-five days from May 12 for their crops to be ready for gathering.

When the leaves show the necessary yellow tips, they are carried to the house, and there threaded into long bunches by a large flat needle, about a foot long, passed through the stalk of each. These are then exposed to the sun to dry, and some months' exposure is necessary before they are sufficiently matured for baling. Rain sets in at a later period, and the tobacco, becoming moist and fit for handling, is then removed from the threads and made into bundles or "hands" of about sixty leaves each, and tied around the stems. These bundles are piled against the walls inside the dwelling rooms, and a carefully graduated pressure put upon them. The tobacco is next baled, the bales averaging in weight about 110 English pounds. The covering of the bales is a sort of netting made, by the peasants, from goats' hair; it is elastic, and of great strength. The Turk and his family, it will be seen, have now been occupied upon their tobacco crop for nearly a whole year. The leaf is just becoming a bright light yellow when it falls into the hands of the merchant, and it is during this period that the process of fermentation or heating generally occurs, before which the tobacco cannot be shipped. The bales having been placed in the merchant's store, are left end up until a fermentation or baking has taken place, the ends being reversed every three or four days. In the course of a few weeks a bale is reduced to about two thirds of the original size. It is then placed upon its sides to cool. When it is discovered to be cold, it is broken open by the native tobacco pickers, and every leaf sorted and classified. The patience with which this operation is carried out is truly astonishing.

DR LOUVEL has been awarded a prize of four hundred dollars by the French Academy of Sciences for designing an apparatus for keeping grain in a vacuum, or rather within a vessel in which the air is so rarefied as to kill any granivorous insect.

© 1873 SCIENTIFIC AMERICAN, INC.

SCIENTIFIC AND PRACTICAL INFORMATION.

UTILIZING SUINT FOR THE MANUFACTURE OF PRUSSIATE OF POTASH.

The suint, which forms almost the third part in weight of the raw wool, has been found to be an excellent material for the manufacture of yellow prussiate of potash, which is used for making Prussian blue and other articles of commerce, inasmuch as, after heating, it consists of an intimate mixture of carbonate of potash and nitrogenous carbon. Formerly this suint was exclusively used for the production of potash. Havrez found, however, that it is three times as valuable when directly used for the manufacture of prussiate of potash. While 100 kilogrammes of dry suint, containing 40 kilogrammes pure potash, cost only $3, 100 kilogrammes of the potash of commerce cost from $14 to $16. Thus it will be seen that, by employing the suint, 100 kilogrammes of potash may be obtained for $7.50.

ALCOHOL FROM MOSS.

In the northern governments of Russia, large quantities of alcohol are at present produced from the mosses and lichens growing there in enormous quantities. This new industry originated in Sweden, and was subsequently introduced in Finland. Several large distilleries exhibited such alcohol at the recent industrial exposition in Moscow, where German, French, and English manufacturers praised its quality highly. The net profit is said to amount to 100 per cent.

PROCESS FOR PURIFYING THE CONDENSATION OF ENGINES FROM FATTY MATTER.

The steam condensing from engines always contains fat, resulting from the material used for lubricating. Cail & Co., in Paris, collect the water of condensation in a common reservoir, and pump it into a receptacle provided with a powerful stirring apparatus, consisting of shovels, Archimedean screw, etc. This receptacle is three fourths full, the remaining space being filled with petroleum; the apparatus is set in motion for five minutes, the water being allowed to settle for fifty-five minutes. Five minutes' time is sufficient to separate all the fat which is then contained in the oil, and the purified water can directly be used again. A hundred pounds of petroleum will absorb fifty pounds of fat; it has then a specific gravity of 0·840, but should be renewed when presenting a density of 0·810. It is regained by distillation.

AUSTRALIAN MINERAL CAOUTCHOUC.

This material (described on page 197 of our volume XXVI.) which is now being imported into Germany, occurs in Coorong in moderately thick layers on the sand. Analyses seem to indicate that it stands in a generic relation to petroleum, but why it has been deposited in that peculiar form must be left to future investigations.

TO PROTECT CLOTH AGAINST MOTHS.

Reimann, in his *Färberzeitung*, recommends for this purpose steeping the cloth for twelve hours in a solution prepared in the following manner: Ten pounds of alum and twenty pounds sugar of lead are dissolved in warm water, the mixture being left undisturbed until the precipitate of lead sulphate is deposited. The clear liquor, now consisting of acetate of alumina, is then drawn off and mixed with 130 gallons of water, in which a little isinglass has been dissolved. When well steeped, the goods are dried and finished by pressure or otherwise.

TARTRATE OF MANGANESE.

The action of permanganate of potash upon organic matter in general is to destroy it. Not only is glycerin decomposed with violence when allowed to drop into a hot, concentrated solution of permanganate of potash, but alcohol, aniline oil, and other organic substances, including the organic acids, are decomposed, partially or entirely, by it. Notwithstanding this violent action of the permanganate upon organic acids, Anton Fleischer has succeeded in preparing both a tartrate and oxalate of manganese. The neutral tartrate of manganese obtained was found upon analysis to have the composition represented by the formula $C_4H_4MnO_6$. It is slightly soluble in water, 1,000 parts of water dissolving only 2·17 parts of the salt. On adding alcohol, it crystalizes out. When moist, it is rose red; when dried over sulphuric acid, it has a lighter color; at the temperature of boiling water or above it, it is almost colorless. It dissolves readily in mineral acids. What practical use can be made of it remains to be investigated.

ELECTRO-POSITIVE STATE OF AN INSULATED CANDLE FLAME.

When an insulated flame is placed between the balls of a discharger connected with the positive and negative conductors of an electrical machine, the flame is attracted towards the negative pole so strongly as to ignite a piece of phosphorus attached to that pole. If a piece of burning phosphorus be placed between them, the phosphorus on the positive ball soon burns, and the long column of phosphoric acid vapor is also attracted to it and forms with it the phosphate of the metal.

COOLING WATER BELOW THE FREEZING POINT.

A glass tube closed at one end and blown to a bulb near the upper end, and the upper limb bent and drawn to a point, is filled to the middle of the bulb with distilled water that has been boiled. The water is heated to drive the air out of the tube, and the tube is sealed by the blowpipe. Another tube of the same form, but not bent and drawn to a point, is filled with water that has not been boiled and hence contains air. The two are now placed in a freezing mixture, and after the water in the open tube has frozen, the other will be found to be still liquid. On taking it out of the freezing mixture and shaking, it will instantly congeal.

HAY MITES.

Some time ago, there died a large number of horses in Nordheim, Germany, from inflammation of the intestines, the true cause not at first being known. At last it was assigned to the hay, in which, upon close examination, an immense number of microscopic animalculæ were found. They belonged to the genus *acarus fœnarius*, to which genus the mites living on dry fruit and in cheese also belong. In times of horse diseases it might, therefore, be proper to microscopically examine hay and straw, since even the best fodder, if stored in a damp place, is very likely to be infested by those and other parasites.

TESTING WATER FOR HYGIENIC PURPOSES.

One third of a fluid dram of the water to be tested is evaporated on the object glass of a microscope, on which a small reservoir has been formed by cementing a glass ring upon it. The temperature should be about 120° Fah., not higher. The residue from pure water, when examined under the microscope, reveals only colorless, dendritic or sharply defined crystals of carbonate of lime. But if the water holds organic substances in solution, the residue exhibits more or less imperfectly formed crystals of a yellowish or reddish color; and, if the impurities are considerable, it shows twin crystals and triangles with obtuse angles and other distorted forms. Experiments prove that less than a one thousandth part of urine or decomposing organic matter is sufficient to change the appearance of the residue considerably.

DURABLE CRUCIBLES FOR MELTING STEEL.

Such crucibles are prepared from a mixture of 10 parts ground and washed chamotte, 10 graphite, 15 asbestos, 3 quartz (not too finely powdered) and 22 fireproof clay. The asbestos, as a fiberous body, prevents the falling asunder of the crucible when cracking, and thus any loss can be prevented.

ORIGIN OF ELECTRICITY.

Dr. Louis Elsberg, of New York city, has communicated a new theory of the origin of electricity. According to this scientist, the number of vibrations executed by the molecules of an electrified body are between those of sound and heat, namely, they exceed 38,000 a second (at which point the consciousness of sound ceases altogether) and are below 200 billions in a second.

EFFECT OF DIFFERENT COLORED LIGHT UPON THE AMOUNT OF CARBONIC ACID GAS IN RESPIRATION.

Two Italian investigators, Selmi and Piacentini, have instituted an interesting series of experiments to determine whether different colors affected the respiration of animals as they are known to affect plants. The animal to be experimented upon was placed in an air tight box into which no light could penetrate except such as passed through glass of a given color. Air freed of carbonic acid was constantly admitted into the box, and escaped by a second opening, where it was passed through a vessel which contained some absorbent of carbonic acid, so that its amount could be accurately determined. Representing the quantity of carbonic acid respired by a dog, in a given time under white glass, by 100, the amount given off under black glass was 82·07, under violet, 87·73, under red 92, under blue 103·77, under green 106·03, and under yellow 126·83. The difference was still greater when the experiment was tried on a pigeon and on a hen. The authors came to the conclusion that green and yellow rays, which are the most important to the vegetable kingdom in taking up carbonic acid, are also most favorable to the respiration of animals, that is, enable them to give off the most carbonic acid. Previous investigators have reported in favor of blue glass, so that the question is not yet fully settled.

ANTIMONY AN EXPLOSIVE METAL.

If a piece of copper foil be attached to the negative pole of a galvanic battery, and a piece of platinum foil to the positive pole, and the two immersed in a hydrochloric acid solution of antimony, the antimony will be precipitated as a metallic mirror on the surface of the copper. After removing it from the liquid and carefully washing with distilled water, the brittle antimony can be removed by bending the copper back and forth. Antimony thus obtained will explode upon being rubbed in a mortar or struck with a hammer, light and heat as well as detonation being produced by the explosion. The reason of this extraordinary action of only one metal is due to the rapidity with which it returns from the amorphous form to the crystaline.

BENT WOODWORK IN CARRIAGE MAKING.

BY HENRY F. PORTER.

It is only recently that much attention has been paid to the bending of different wooden parts of a carriage. Not only in this country, but also in Europe, it has long been customary to saw out crooked pieces, and when lately we resorted in preference to bending, it was not only for the purpose of saving material but particularly for the reduction of weight and the greater durability of the pieces. The latter is a very important point. The saving of weight is twofold. In the first place, a piece which is to be bent can originally be sawn out in a reduced size, for the reason that the grain will all run parallel with the sweep when the wood is bent, and thus such a piece does not require to be stronger at any particular point as a piece sawn cross-grain always must be. The second point in which weight is saved is that a bent piece requires for plating only one half the size of iron of that which must be put on a cross-cut piece. We will illustrate this with the example of a rockaway perch, or, in other words, a perch for the heavier class of work. If such a perch is sawn out cross-grain, it will require to be plated on all four sides, thereby considerably increasing the weight without adding to the durability. We have seen many cases where the incessant vibrations and jerks, to which the perch is exposed under all conditions, have caused the wood to be chawed off by the ironing, occasioned by the exposure of the cross grains. If, on the other hand, the perch is bent a single iron plate on the bottom is all that is required, and there is no possibility of the wood getting damaged by it, as all the grains run parallel and present a smooth surface not easily attacked. The point of durability has long been recognized by leading eastern builders, and, on such work as the Concord coach, of which the proverb says "it wears but never tears," we find the back pillars, bottom pieces, and most of the crooked parts all bent. Scarcely any kind of vehicle has been exposed to such hardships as the old overland stage, and it was early found that cross-cut parts could never withstand such trials as upsetting, rolling down ravines, etc., incidents so common on the old perilous overland route. When bent, such pieces, as a rule, never broke. This example goes far to show that it is preferable to bend perches, whenever practicable, instead of following the old method of cross sawing. Still, there is another and very material point to be obtained in making perches. It will frequently be noticed, on perch carriages, that it seems to have been the aim of the maker to conform the sweep of the perch as near as possible to the lines of the body; and this produces, in many instances, a very crooked perch, a circumstance which is rather unfavorable to durability.

In speaking of perches, it may not be out of place, although not coming under the heading of this article, to say a few words with reference to straight double perches for wagons. It has been customary to plate these underneath, by bolting a perch $1\frac{3}{16}$ inch square with a $\frac{3}{16}$ bolt, which in reality leaves not sufficient strength in the wood to resist an extraordinary strain, such as may be caused by accidents, or even by ordinary wear and tear. It has been tried for this reason, and found to be perfectly practicable that these perches for wagons are not ironed through their whole length, but only sectionally at both ends, namely, nine inches on either side. In this way the inevitable vibrations can take place unobstructed in the middle of the perch, and the resistive power of the wood is not endangered or lessened by any holes. Plating in general is of no account after the wood has given way. Besides perches, there are other important pieces of bent work connected with carriage parts, namely, bottom-beds, futchels, back bars, and shafts. As for the bottom-bed, its arch is, in the first instance, conditioned by the hanging of the body, and next by the hight of the front wheels. If the body is to be hung low, the bed will have little or no arch; and if the wheels are low, it will require more arch on the bed in order not to get too high a carriage part. The extreme hight of carriage parts should never be more than twelve inches for the heaviest work, which of course is considerably reduced for lighter classes of work. The arch of the bed is also limited by the consideration of obtaining the proper position for the pole, and we cannot give here fixed measures, because they vary in almost every instance. What we wish to convey is that a bent bed, even when arched as much as four inches or more, is still safe, and that a bed sawn across grain, whose arch a contemporary thinks should be limited to $2\frac{1}{2}$ inches, is more unsafe than a bent one with double this amount of arch.

Back bars, when they have to be arched, should always be bent. The curve required can be sawn out. In the case of bars, the grain of the wood is not exposed to friction, and therefore there is no danger of checking. Back bars have, under certain circumstances, to stand a considerable strain. When the vehicle is moving on a sloping road, the whole weight is thrown on one side, and the bar is thereby given a tendency to twist. The motion of the springs also is often not the same on each side, for instance, when one wheel meets with a resistance while the opposite runs on smooth ground. Jerks thus caused are transmitted to the bar, with a somewhat reduced force, it is true, but still with such intensity as to call for the best material. On C spring carriages, the back bar will have to be plated with band iron, or made wholly of iron, as is now frequently done.

Shafts and poles for wagons have been bent for a number of years, for the same reasons which we gave for the other parts. Our intention has been to call attention to the decided advantages obtained by having all pieces bent over the old plan of sawing them out. The progress made in bending during the last few years is worthy of notice, and proves the patronage and encouragement given it by the trade. It is only a few years since one of the first leading firms in this country experienced great trouble in bending double sweep ash and hickory top beds to a sweep of five inches. Nowadays they find no difficulty in bending perfectly, and without split, seven to eight inches. A further illustration is the advance made in the bending of rims. A rim bent at present is less in size and just as durable as a heavier rim was some years ago, both for the same size of work. It is made for top wagons at present $\frac{7}{8}$ inch deep, with $\frac{5}{8}$ inch tire. This progress was in a great measure brought on by machinery, and it is but just to say that, for all similar wants of our trade, requiring the ingenuity of others, we are promptly met by inventions of the most excellent tools and materials. This fact in itself should be an encouragement to us to keep on the road to improvement and perfection.—*The Hub.*

FEW things are impracticable in themselves, and it is for want of application, rather than of means, that men fail of success.

© 1873 SCIENTIFIC AMERICAN, INC.

An American Doctor in London.

Dr. E. P. Miller is writing from Europe, to *The Laws of Life and Journal of Health*, edited by Harriet N. Austin, M. D., and published at Dansville, N. Y., some very interesting letters. From a lengthy letter from Dr. Miller in the January number, we condense the following extracts:

There are some things in this world so vast that it is literally impossible for finite minds to comprehend them. It is true we are not quite so lost in thought in their contemplation as when we attempt to search the boundaries of space or number the fixed stars, yet we are amazed to find how much there is to learn, and after all we have done, how little we know.

London is a world of itself, and it would require more than a lifetime to know it. There are more than 3,000,000 human beings, crowded into an area of about 122 square miles. There are about 6,000 public houses, wine cellars, and beer saloons, where alcoholic liquors are sold, and these places dispense 43,200,000 gallons of ale, 7,800,000 gallons of wine, and 2,000,000 gallons of other strong drinks every year. As a result they have 129,000 paupers, and it requires 5,000 lawyers, 2,000 ministers, 3,000 doctors, and 500 undertakers to take care of the criminals, sinners and sick people.

Nearly every street you traverse, and public or private building you examine, has a history of its own—many of which date back hundreds of years.

THE LONDON UNDERGROUND RAILWAY.

Dr. Ellis kindly invited me to visit the Crystal Palace with him on the day following my arrival, and I gladly embraced the opportunity of accompanying one so familiar with the grounds. The Crystal Palace is about six miles from my hotel, and the most convenient mode of reaching it was by the Underground Railway. I had wanted an opportunity to examine this subterranean enterprise, and was both surprised and delighted with its workings. It has become one of the indispensable necessities of London. They could no more get along without their underground railway than could New York without horse cars. Trains pass on these roads every ten or fifteen minutes, and a train often carries four or five hundred passengers. The stations are frequent and convenient, and the cars are so constructed that a stoppage of not more than one or two minutes is required to load and unload an entire train. The cars are well lighted and frequent openings of the roadway to the surface secure tolerably good ventilation. The engines in use condense their own steam and consume their smoke, so that these nuisances are almost entirely avoided.

THE CRYSTAL PALACE.

The train I took stopped at the Crystal Palace grounds; and, as I stepped out from the depot, at a short distance in front and above me stood that magnificent temple of glass and iron glistening in the sunlight, while all about, for acres, was one grand parterre of flowers and fountains. I can never forget the sudden change in my feelings as I passed from that subterranean passage of darkness to the magnificent scene which was the very perfection of light. I was literally chained to the spot. It was like a fairy vision, so beautiful; I thought of the Bible description of "the Holy City coming down from God out of Heaven prepared as a bride adorned for her husband," and of the time when "all tears shall be wiped away and there shall be no more death, neither sorrow, nor crying, neither shall there be any more pain, for the former things shall be passed away." It seemed to me that all the beautiful things that were ever thought of in Paradise were concentrated here. I do not think it possible to find another place where can be seen more of the beauties of nature and of art in three or four hours' time than at the Crystal Palace.

The interior fulfilled the promise of the surroundings. Outside there are acres of flowers, tropical plants, trees, shrubs, and vines, native products of different countries and climes, growing in all their freshness and beauty. Acres of fountains, in glass and out of glass, picture galleries of ancient and modern masters, statuary, architectural products and manufactured articles, pictures and wax representations of all the different nations and tribes of people, and of the different beasts, birds, fishes, and insects. I am quite sure Noah's ark was not half as large, nor did it contain half as many curiosities, or cost half as much to build it.

A concert is given in the Crystal Palace every afternoon. The view of the fountains in full play, when seen from the balcony of the Palace, beggars description. There are hundreds of them of every conceivable variety and form. the water being supplied from towers 260 feet in hight, which are erected on the grounds.

The Crystal Palace cost about $6,000,000, and not far from $3,000,000 are annually expended in supplying it with new curiosities and defraying the running expenses. May it always stand an emblem of the ingenuity, industry, enterprise, intelligence, and refinement of the English people!

I must confess my opinion of the English people was essentially changed by an acquaintance with them. They are a great people. They are proud of their race, and justly so. They are honest, industrious, and educated. They are above the average of the human race in health, physical strength, and endurance. They are fond of out-door life, of sports, of physical exercise, and social enjoyments.

REMEDIES FOR SORE THROAT AND NASAL CATARRH.

Dr. Ellis gave me a simple recipe for throat and lung affections with which I propose to close this article. Upon my remarking on my tendency to such affection, he said "Now, Doctor, you may go home and thank God for having seen me, for I will give you a simple remedy that will be the means of prolonging your life many years. Get a silk ribbon an inch or more wide, tie it about your neck and wear until worn out and then replace it, and continue to do so." I confess I was a little surprised to find a man of Dr. Ellis's intelligence relying with so much confidence on such a remedy, and I asked an explanation of its virtues, but this he was not prepared to give. If any reader tries this or the following remedy, I should be pleased to know the result.

A remedy for nasal catarrh which I think of some value, I will also give. Many cases of catarrh are caused by inability of the liver to perform its function properly. In such cases there is often a too alkaline condition of the blood. When this is the case, the liver does not take out as much of the carbon and other substances as it should, and the mucous membrane of the nose becomes a dumping ground for the foul matter. If persons thus afflicted will squeeze the juice of a good sized lemon into half a tumbler of water and drink it without sugar just before dinner, they will, if they live hygienically, be surprised to seen how soon the catarrhal difficulty will diminish. When it fails to do so, it may be considered as due to other causes.

New Apparatus for Testing Quality of Lubricating Oils.

This machine, recently patented by R. H. Thurston, Hoboken, N. J., affords a means of making a combined dynamometrical and thermometrical test of the lubricating value of any lubricant, and also of determining, at the same time, its power of sustaining heavy pressures and its durability under any required pressure.

A journal, on a shaft running in a securely mounted frame, is grasped by a clamp and the boxes are set up to any desired intensity of pressure by a powerful screw compressing a spring; the pressure is known from the reading of a suitably arranged scale.

The pressure being adjusted as desired, the clamp swings about the journal and, by compressing a spring or by raising a weight, determines the exact amount of force required to overcome friction, by the reading of another scale.

A thermometer, set in the journal brass, indicates the commencement and progress of any heating of the journal. The time required to beccme heated and to burn off, under a given pressure, will indicate the durability of the oil where it may be exposed to such a pressure.

Several forms of machine are described for special classes of lubricants, as for heavy oils for locomotives, at the one extreme, and for the light oils used on sewing machines and other light machinery, at the other extreme.

The Spread of Fires in Cities.

A correspondent, R. B. V., of Md., says:

"It strikes me that the greatest cause of the spread of fires is the falling of the walls of the houses as they are burned out, a dread of which, in very many instances, keeps the firemen back from the work. If that dread was removed they would rush forward and subdue the enemy; but as houses are now erected, many of the valiant men are crushed to death by falling walls; and not this only. Who has not seen rows of houses all on fire in a few minutes from end to end, just because they were so built that the partition walls, one after the other, had fallen, thereby permitting the fire to go from house to house with such rapidity that all efforts to save them were in vain? To prevent this, permit me to suggest: That the walls be of brick (it is the most fireproof material) and of reasonable thickness, with as few windows as will afford the necessary light and air, with tight iron shutters to each. In all the walls on which girders or joists are to be placed, put good substantial upright fastening that will not burn, for the ends of every girder and joist to fit on; so that each of them, while laying horizontally, will be a reliable stay to keep the walls in their proper upright position, and will be so constructed that, as soon as each girder and joist is either burned or broken in two, they will fall out of the wall without injury to it; for, after all that has been said on the subject, the walls are thrown down by the great leverage given to each girder and joist by the present plan of putting them in the walls. When the falling of the walls is obviated, the standing ones will screen the surrounding property, and the damages of fire will be much less, and can be repaired with less than half the expense of labor, time and money."

Vaccine Virus.

M. Chauveau has succeeded in separating, in a pustule of vaccine, a serous matter and molecular granulations, in order to inoculate with each, separately and comparatively. He has found that the vaccinal serum is not virulent, and that the activity of the virus resides in the solid granulations. On the addition of water, the granulations deposit themselves, and so long as the mixture is in repose, the water is unaffected. If, however, the liquid be agitated, the granulations expand and communicate the virulent property to the whole. It has been determined that vaccine thus weakened with fifty times its weight of water is as certain in its action as if in concentrated form. M. Chauveau therefore concludes that in the pus of the variola and of the morbid affection, as well as in the vaccinal liquid, the specific activity which constitutes virulence resides exclusively in the elementary corpuscles held in suspension by the humors.

An African Steam Gage.

H. A. M., an esteemed Southern correspondent, sends us the following anecdote: Not many miles from Panola county, Miss., a certain wealthy planter has a cotton gin run by steam. Upon one occasion, he invited a mechanical friend up into the gin house to see it work. After showing the premises, he called out to his old Ethiopian fireman: "Sam, are you ready to start?" The old man ran his hand backward and forward over the surface of the boiler, and, with a face important with grave judgment, replied, "No, Marse Abe, I don't tink she quite hot enough yet." "Good Lord," exclaimed the mechanical friend, "is that your steam gage?" and he left the gin house. Fact, gentlemen.

Forests and Drought.

T. S., of Pa., writes to say that it lies with us to decide whether our continent shall retain its present luxuriance and salubrity to remote ages or not. He regrets the rapid diminution of our forests, and the decrease of moisture in the interior parts of the country; and concerning the latter point he states that, in some parts of the country, where five feet of snow usually fell in a year, there is not now five inches.

"Sardinia and Sicily, once the granaries of Italy, have suffered the penalty of their thoughtlessness in exterminating their forests. Two thousand years ago, those lands were celebrated for their wonderful productiveness, and were said to be the most beautiful in the world. In 1800, Humboldt visited Venezuela, South America, and was informed by the natives living in the valley of Araguay that they had noticed, with great astonishment, that a lake which lay in the middle of the valley had decreased in volume every year; the cause of this is clearly traced to the felling of a great number of trees which grew on the surrounding mountains. In Hungary the periodical droughts are universally attributed to the annihilation of the forests. In Cairo, Lower Egypt, a great many years ago, rain fell but seldom, only once in three or four years; but since the time of Mohammed Ali, twenty to thirty millions of trees have been planted, and the result is now that the people have from thirty to forty rainy days every year. Surely these few of the many examples are warnings sufficient to put us on our guard."

Facts for the Ladies.—Mrs. D. Magra, Saratoga Springs, N.Y., has used her Wheeler & Wilson Lock-Stitch Machine about two thirds of each year since 1860, and earned annually about $500, with no expense for repairs. See the new Improvements and Woods' Lock-Stitch Ripper.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 5 to December 11, 1872, inclusive.

CLARIFYING OILS, ETC.—F. Kersting, Grand Rapids, Mich.
CUTTING PLIERS.—N. Thompson, Brooklyn, N. Y.
GAS OR LIQUID METER.—D. B. Spooner, Syracuse, N. Y.
HORSE SHOE NAILS.—A. Alden, Cambridge, Mass.
INSULATING COMPOUND.—Z. G. Simmons, Kenosha, Wis.
LAMP.—J. H. Irwin, Philadelphia, Pa.
MIDDLINGS PURIFIER.—W. W. Huntly, A. P. Holcomb, A. Heine, Silver Creek, N. Y.
ORDNANCE, ETC.—W. E. Woodbridge, New York city.
RAILROAD COUPLING.—H. C. Kibbe, San Francisco, Cal.

PATENT OFFICE DECISIONS.

REED ORGANS.—GOODMAN *vs.* SCRIBNER.—INTERFERENCE.—APPEAL FROM THE BOARD OF EXAMINERS-IN-CHIEF.

In an interference between an application and a patent, where it appeared that the patent had been granted during the pendency of the application without an interference: Held, that the parties should be treated as if both were applicants. Goodman's patent sustained.

COMBINED CLEVIS PIN AND WRENCH.—LLOYD *vs.* ENGEMAN.—INTERFERENCE.

Held, that a case may be referred to the Commissioner in person when, in the judgment of the Examiner of Interferences, the interference has been improperly declared and the case has passed beyond the jurisdiction of the Primary Examiner.

The mere exchange of a feature of a device for a different but not novel one of the same kind, to be used in the same way, does not indicate invention.

REFRESHMENT CARS.—AMOS M. SMITH.—APPEAL FROM THE BOARD OF EXAMINERS-IN-CHIEF.

An arrangement of rooms in a dwelling, railway car, or other structure is not a proper subject for patent; such arrangement does not constitute patentable novelty.

THACHER, *Acting Commissioner:*

The following is the claim;

I claim the combination and arrangement of the side passage, B, the saloon, H, store room, G, counter, D, passage, E, and open space, C, substantially as and for the purpose specified and shown.

The grant of patents for improvements of this class can operate only as an unwarran table and vexatious restriction upon architects and builders in the practice of their respective vocations. It is not believed that the spirit of our patent system encourages the imposition of such restrictions. While great liberality should be shown in the grant of patents for improvements which manifestly tend to promote science, art, or manufactures, it is also important that a wise discretion should be exercised to prevent the placing of unnecessary restrictions upon artisans in a legitimate use of their mechanical skill and ingenuity. Due regard must be had for the rights of all parties in the consideration of questions affecting the right to a patent, and that policy should be adopted which seems most favorable to the promotion of the public good. In my opinion sound policy demands the refusal of all patents for subject matter such as is contained in the present application.

This seems also to be the opinion of Commissioner Leggett, as intimated in his decision of August 26, 1872, refusing a patent to John Gates for an alleged improvement in steamboats, and the decision of this case is understood to accord with the spirit of the opinion therein announced.

The decision of the Examiners-in-Chief is affirmed.

PRACTICE IN INTERFERENCES.

Rule 59, relating to interferences, is hereby amended by inserting at the end of the first paragraph the words here italicized, so that as amended the paragraph will read as follows:

"An interference will not be declared until the subject matter involved is decided to be patentable; and when once declared it will not be dissolved without judgment of priority, unless it be found that neither party is entitled to a patent or that no interference in fact exists, *when it will be dissolved, and an appeal may be taken to the Commissioner in person.*

M. D. LEGGETT, Commissioner of Patents.

December 30, 1872.

DECISIONS OF THE COURTS.

United States Circuit Court, Eastern District of Pennsylvania.

HARVESTERS.—WM. H. SEYMOUR AND DAYTON C. MORGAN *vs.* JAMES S. MARSH AND OTHERS.

MCKENNAN, *Circuit Judge:*

On the 1st of July, 1851, letters patent were granted to Aaron Palmer and S. G. Williams for "improvements in grain harvesters." This patent was reissued in divisions, one of which was numbered 1,682, which was extended for seven years from July 1, 1865.

On the 8th of July, 1851, William H. Seymour obtained a patent for an "improvement in reaping machines," which was also reissued in divisions, two of which were numbered 72 and 1,683, and were extended for seven years from July 8, 1865.

The title to these several reissued and extended patents, 1,682, 72, and 1,683, has been duly vested in the complainants, and they constitute the subjects of the present contention.

These patents embrace several claims, the three following of which only are the defendants charged with having infringed:

1. The claim of 1,682, which is for a "combination of the cutting apparatus of a harvesting machine with a quadrant shaped platform arranged in the rear thereof, and a sweep rake operated by mechanism in such manner that its teeth are caused to sweep over the platform in curves when acting on the grain, these parts being and operating substantially as set forth" in the specification.

2. The claim of No. 72, for "a quadrant shaped platform, arranged relatively to the cutting apparatus, substantially as described, and for the purpose set forth."

3. The claim of 1,683 for "the combination, in a harvesting machine, of the cutting apparatus, with a quadrant shaped platform in the rear of the cutting apparatus, a sweep rake, mechanism for operating the same, and devices for preventing the rise of the rake teeth when operating on the grain, these five members being and operating substantially as set forth."

The defendants resist the complainants' right to a decree upon the grounds that the reissued patents are invalid; that the inventions claimed are not novel; that such inventions will not work practically, and that they are not infringers.

A reissued patent may embrace whatever was suggested or substantially indicated in the original specification, drawings, or model, and the claims may be broader, therefore, than those contained in the first patent.

© 1873 SCIENTIFIC AMERICAN, INC.

If a machine is an advance upon the existing state of the art it is patentable, although it does not at first accomplish perfectly all that was designed nor all that was expected of it, but is found on practice to contain imperfections which can be remedied with ordinary skill.

The opinions of experts that the machine described is impracticable, founded on a literal construction of the specification, are of little weight when compared with evidence of its successful operation in actual use.

The judgment of the Supreme Court upon a question of fact arising afterward in a Circuit Court is entitled to high respect, and, though not binding in law, should be definitive where nothing is alleged which raises a doubt as to its soundness or a suspicion that it would not be repeated on a rehearing.

A harvester with a rake which, by a rotary movement, sweeps the grain from a platform and deposits it in the desired position is an infringement of a patent for a similar harvester with a rake which effects the same result, though by a reciprocating movement.

George Harding, for plaintiffs.
Messrs. Maynard and Parker, for defendants.

United States Circuit Court---Northern District of Illinois.

"GERSTEN" LANTERN DEFLECTOR.—JAMES F. DANE, WILLIAM WESTLAKE, AND JOHN P. COVERT *vs.* CHICAGO MANUFACTURING CO.

[In Equity.—Before Judge Blodgett.]

The bill of complaint in this case sets forth that on the 25th of January, 1859, a patent was duly issued from the United States Patent Office to one Conrad Gersten, for an improvement in lanterns; that said Gersten afterward duly assigned the said patent to the complainants Dane & Westlake; that after receiving said assignment, said Dane & Westlake surrendered said letters patent, and made application for two new patents to be issued for the same invention, with corrected descriptions and specifications; and that on the 16th day of September, 1867, new letters patent, each for a distinct and separate part of the thing patented as aforesaid, and each for some material part of the original invention, afterward were duly issued to said Dane & Westlake, as assignees of said Gersten, and that one part of said reissued letters patent was numbered 2,765, and that a legal corrected description of that part of the original improvement contained in said reissued patent 2,765, was given in the words of the said Dane & Westlake, annexed to the said part of the said reissued patent; that afterward an equal undivided interest in said reissued letters patent was duly assigned by the said Dane & Westlake to the complainant, John F. Covert; that the defendant is making and vending lanterns containing substantially the improvement and invention described in, and secured to, the said complainants by the said reissued letters patent 2,765, and they ask relief in the premises.

Defendant, by its answer, denies the validity of the said reissued letters patent, and also denies any infringement thereof; and evidence upon both these points has been taken and fully discussed by counsel on both sides.

The main point in regard to the validity of the patent is made upon the question of novelty; and on that question the state of the art at the time, and before the time of Gersten's alleged invention, has been very fully discussed and examined by counsel.

The feature in the Gersten patent, of which the infringement is alleged, is the plate or deflector.

It appears from Gersten's specifications that the general scope and purpose of his invention was a lantern, in which kerosene or carbon oils could be used for illuminating purposes. *

It is an indisputable fact that nearly all of the inventors who preceded Gersten, whose devices are put in evidence in this case, called their cone or cap, by which the supply of air is concentrated upon the base of the flame, a "deflector," so that it seems Gersten did not invent the name.

We have not time, however, to settle who invented the cone or deflector. It is sufficient to say that when Gersten entered the field experience had demonstrated the necessity of the cone, the periphery of which must extend far enough to fill the chimney so as to induce a strong current of air through the cone and impinge it upon the flame in the slot; a small supply of air being also admitted into the chimney above the cone to feed the flame after it passed into the chimney, and secure the combustion of the particles of soot which were drawn along with the flame into the chimney.

These burners secured a strong white light without smoking, and lamps with this device for burning kerosene or coal oil had come into general use before Gersten's attempted invention, and Gersten's effort was to make a lantern in which kerosene could be used as it then was in lamps. *

No experimenter or inventor had determined just how far outwardly the base of the cone should extend, but all had recognized the inexorable necessity of making the cone form a substantially tight bottom to the chimney, by which alone a draft through the cone could be obtained.

Gersten did this, and nothing more, so far as the cone is concerned. His deflector performs the same function in the same way as the Dietz cone does. It required a mere mechanical alteration and not an invention to expand the base of the cone until it met and filled the walls of the globe at the base of the globe. Thus expanded, it was nothing but Dietz's cone, because it did nothing more. I say Dietz's cone, because Dietz used it in his combination—for he was not and did not pretend to be the inventor—it was old when Dietz took it up. *

It might be enough to stop here in the discussion of the testimony on the question of novelty, but the record shows that some months prior to his invention one Max Miller, a resident of Brooklyn, where Gersten also resided, had attempted the construction of a coal oil lantern in which he used the cone or deflector precisely like Gersten, except that he perforated with small holes his cone, near the base of the boss, so that some of the air which came into the flame chamber escaped into the space above the cone without going through the slot. *

So that when Gersten claimed broadly a deflector extending to the walls of the lantern, he claimed too much, for Max Miller, his neighbor, had done that before him. If he could show that his cone was better than Miller's, by reason of leaving out the holes through which the air escaped into the chimney at the base of the boss or cone, he might have had a patent on his improvement on the Miller deflector, but he did not ask for or obtain that. He claimed broadly in the reissued patent the deflector as such, and it seems clear to me the testimony proves that Miller had anticipated Gersten in the application of the cone to a lantern in all essential particulars.

Bill dismissed with costs.

REMOVABLE GLOBE LANTERN.—JAMES F. DANE *et al. vs.* CHICAGO MANUFACTURING COMPANY.

[In Equity.—Before Judge Blodgett.]

This is a bill in equity to enjoin the alleged infringement of patents issued by the United States to William Westlake for an improvement in lanterns, dated April 26, 1864, and reissued to complainants as assignees of Westlake on the 23d of December, 1869, designated as reissue No. 3,747.

BLODGETT, *Judge:*

The nature and object of the invention, as set forth by the patentee in his specifications, "consists in the construction of a lantern guard without hooks, projections, or catches sticking out or interfering with the safe and convenient use of the lantern, so that the same can be readily attached or detached; in the employment of a band or disk to fill or cover the space between the enlarged band or ring at the upper end of the guard and the top of the globe; and in the application of suitable fastenings to secure the dome to the guard." *

Finding, then, from the testimony that Westlake's alleged invention had been fully anticipated by the prior invention of Waters, it is hardly necessary to discuss the question of infringement.

This bill, or rather these two bills, must therefore stand dismissed with costs

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

ROCKING CHAIR FANS.—Otto Matzke, Durant, Miss.—The invention consists in the mode of operating a fan pivoted in an overhanging rocking chair by means of a single lever and cord. When a person is sitting in the chair and rocks forward, the lever will work upon its fulcrum, and its back end will be depressed, which will draw down the cord and throw the fan outward or operate it in one direction. When the fan is thus thrown from the perpendicular, the back motion is produced by its own gravity. A rocking motion of the chair is thus made to operate the fan and produce an agitation of the air, which is pleasant and agreeable to the operator.

BENCH PLANE.—Jacob Lehner, Galena, Ill.—This invention consists of a combination of screw rods, nuts, and an adjusting bar, with the plane stock and bit, in such manner that the setting of the plane bit is effected by turning the nuts on the screw rods, the latter being attached to the plane stock at each side parallel with the bit. The invention also consists of a combination of a tightening rod with the wedge and plane bit for securing and releasing the latter; the said rod passing from the heel of the plane stock through the plane bit and its cap, which are slotted at the center for the purpose, into the wedge, in which it screws, and the plane bit having two other slots, one at each side of the center slot, for the screws, by which the cap is secured to it, to allow the tightening rod to pass through the center slot.

CHAIR.—Daniel L. Akers, Evansville, Ind.—In this particular kind of chair (the hand plaited bottom chair), the bottom has been usually attached to and supported by the rounds or stretchers, which renders it necessary to complete the chair, which made it too bulky for shipment. To overcome this difficulty the inventor makes the seat separate, and attaches it to the frame of the chair by means of gains in the two back posts and in the two front legs. The bottom is supported by these gains, and when the chair is put together with glue, or is otherwise fastened, the bottom is secured and supported in a most substantial manner.

FRAME FOR SHADE AWNINGS.—Joseph Drechsler, New York city.—This invention has for its object to furnish an improved frame for connecting the lower end of a window shade with the lower part of the window casing or frame in such a way as to adapt the shade to be used as an awning, and which shall be readily detached, and which may be folded together upon the lower part of the shade; and it consists in a frame constructed to adapt it to be applied to a window frame or casing and to the shade.

VEGETABLE GRATER.—John Keagy, Newark, Ohio.—This invention consists of a connection of the hollow sheet metal punched grating cylinder to the shaft detachably, for taking it off readily to clean it, by flanged ends of the spider arms fitting against the inside of the cylinder, and clips of sheet metal soldered on the cylinder and extending around the sides of the flanges. The latter are inserted between the clips and the cylinder by moving the cylinder endwise along the flanges, or the spiders along the cylinder. They are kept in position by a fixed collar on the shaft for one spider and a washer and pin for the other.

APPLE PARER.—William A. C. Oaks, Reading, Pa.—This invention has for its object to furnish an improved apple parer, which shall be so constructed that the parings will fall clear of the working mechanism of the parer, so that they may all be received in a vessel set beneath, and cannot clog the machine; and it consists in the standard or frame made with a bend or angle to throw the upper part of said standard, that carries the fork, forward to allow the parings to drop clear of the operating mechanism of the parer. The knife begins to work close to the shank of the fork, and moves forward as the apple is revolved. When it comes into a position opposite the fork, and has thus completed the paring, the lower end of an arm strikes a guide flange which throws the upper or knife end of the arm back from the apple, and holds it back until the said arm has passed beneath the shaft and has come to the place of beginning, thus allowing time for the pared apple to be removed and an unpared apple to be placed upon the fork.

DISH WASHER.—Augustus W. Thornton, Mendocino, Cal.—In using this apparatus after it is attached to the sink or vessel, the dishes to be washed are placed in such sink or vessel, and boiling water is poured thereon, and they are then pushed through between two bars covered with sponges and held together by springs. The grease, being softened or dissolved by the hot water or suds, will be wiped off clean. The dishes are then rinsed in hot water, and then drained and dried automatically by means of the heat absorbed from the boiling water.

MOLD FOR CASTING.—William B. Robinson, Detroit, Mich., assignor to himself and Jefferson Wiley, of same place.—This invention consists of a combination, with metallic molds for making composition castings and the like, of a gate mold of sand adapted to retain a surplus quantity of molten metal above the metallic mold, to flow into the latter as the metal therein cools and shrinks, to compensate for the shrinkage and produce castings of the exact size of the metallic molds.

VAPOR BATH.—Warren Estabrook and Samuel J. McDonald, Gallatin, Mo.—This invention is an improvement in the class of vapor bath apparatus in which the case employed is provided with a top and side adapted to open to receive the patient, and with a perforated seat and a vaporizing furnace and the invention consists in the arrangement of heat fenders or screens with relation to a seat and foot support, and of a receptacle for containing a furnace, the same being provided with a sliding cover, whereby the intensity of the furnace fire may be lessened or inclosed so as to exclude the air and extinguish it, etc.

BARREL STAVE AND VENEER SAWING MACHINE.—John McGrew, Ravenswood, W. Va.—The invention consists in a new mode of advancing the carriage after each hoop is cut, by means of a scroll.

DETACHABLE DRIP CUP FOR BOTTLES.—The invention relates to the cup or circular trough which has heretofore been applied about the necks of bottles in order to receive the drip or waste liquid which exudes from the mouth and trickles down the side of the neck. Heretofore these have always been blown, cast, or otherwise formed in one piece with the article to which they were attached. This invention consists in forming them separately of elastic material, so that they may be rendered attachable or detachable, as occasion may require.

BALE TIE FASTENER.—Robert S. Sayre, Stilesborough, Ga.—The object of this invention is to furnish efficient and convenient means for lessening the labor and time now required to bale cotton and similar material; and it consists in a lever with a slotted swinging plate attached thereto, and in a detached slotted hook plate so arranged as to draw the two ends of the band together and fasten the same in a few seconds of time and with but slight power.

INSECT TRAP.—Chauncy W. Curtis, Osborn, Mo.—This invention consists in a pedestal and standard, the latter of which contains a socket in which fits a spindle attached to a top piece. Said top piece may be freely rotated, and serves as a place of deposit for food, etc., which is protected from insects by a basin of water through which the standard passes.

BRIDLE.—James H. Wilson, Brentwood, Tenn.—The invention consists in a single strap having branches passing through rings of the bit and attached to a rein so that a pull upon said rein will draw the bit upward in the mouth of the horse.

AUTOMATIC CAR BRAKE.—James B. Pelton, Mt. Pleasant, Md.—The invention consists in a new mode of giving a yielding pressure to the shoes; in a novel means for locking a loose windlass to a car wheel so that it will turn with one of the axles; and in a novel means for moving the windlass or drum to or from the wheel to clutch or unclutch it.

GIN FILING MACHINE.—Lewis Monroe Asbill, Ridge, S. C.—The invention consists in providing the file holders of a gin saw filing machine with certain hinged plates, file plates, spring plates, and slides, whereby the whole operation of sharpening is made more uniform, the necessary time curtailed and the whole operation greatly facilitated.

PORTABLE SHOW SEAT.—David C. Price, St. Paul, Minn.—The invention consists in show seats, detachable and folding together; and also in suspending, on a subjacent band of seat board supporters a series of footrests. These improvements not only render the seats much more agreeable to spectators but enable them to be much more easily packed away and conveniently transported.

REVERSIBLE SCREW FAN.—William H. Goyne, Shamokin, Pa.—The object of this invention is to furnish a rotating fan, constructed upon the screw principle, which shall be adapted for the ventilation of mines and for other purposes; it consists in a series of spirally shaped blades or buckets confined between a closed drum on a rotating shaft and a surrounding cylinder or casing. The sides of the drum and cylinder are parallel, and the buckets or blades conform thereto. The drum is closed, but the cylinder is open at both ends so that air can be forced in either direction. This fan may be made of any length and diameter, and of any suitable material. It is calculated to exhaust the air from a mine or to force air in by simply reversing the motion.

PICTURE NAIL.—Cecil B. Jenkins, New York city.—This invention consists in having the hole through the bottom of the cup which holds the porcelain head a little smaller than the nail shank, with numerous radial slots extending from it to separate the metal into sections capable of springing so as to yield and allow the nail shank to enter when forcibly presented, and then so pinch and bind upon the shank as to hold the head on with sufficient strength. As a further security, the nail shank may have a slight groove around it, a short distance from the end, for the ends of the spring to fall into. An inverted cup, with a hole in the bottom coinciding with the hole of the outer cup, is placed inside of the latter to prevent the porcelain head from coming down to the bottom, so as to maintain a sufficient space between the outer cup and the back of the porcelain head for the nail shank to enter as far as required.

DUMB WAITER.—Louis Carrier, New York city.—This invention relates to a new manner of suspending and balancing dumb waiters, with the object particularly of holding the suspension rope tense by the same weight that acts as balance for the dumb waiter. The invention consists in such an arrangement of said rope, and in such a manner of placing the pulleys and devices which hold it, that there will altogether be but one rope used for raising, lowering, and balancing the dumb waiter, the balance weight always holding it tense. The invention also consists in a new style of double acting clamp for taking hold of the rope and holding the dumb waiter at suitable hight.

DRY GOODS RACK.—David Keiser, Reading, Pa.—This invention has for its object to improve the construction of the improved dry goods rack for which letters patent No. 131,221 were granted September 10, 1872, to the same inventor, to make it more convenient in use while being more capacious; and it consists in the combination of the detachable partitions or upper platforms with the pivoted platforms, standards, and detachable bent rods. By suitable construction, by removing the rods the upper platforms or partitions may be lifted off the standards, or raised to any desired hight above the upper ends of the short standards, where they will be supported by the said standards. In the free ends of the platforms and in the corresponding ends of the partitions are formed holes to receive stops, against which the end of the lowest piece of goods rests so that it will not slip upon the said platform or partition while drawing out a piece above and near to it.

BOOT FOR HORSES.—Joseph Fennell, Cynthiana, Ky.—The object of this invention is to provide convenient and efficient means for preventing "interference" in horses, or to prevent ill consequences when interference or overreaching occurs; and it consists in a boot constructed in two parts, connected together by a flexible ligature. This lower portion of the boot, in order to fit the place intended, is made somewhat convex on the inside, or is curved from end to end vertically. With the boot thus attached the horse cannot injure himself when going at a high rate of speed by overreaching or interfering.

CHAIN PROPELLER.—John Neumann, Brooklyn, E. D., N. Y.—This invention consists of an endless carrier of wire ropes, chains, or belts running the whole length of the boat, over a drum at each end, in a channel along the center of the boat, at the top, the ends, and the bottom, with numerous buckets extending across the belt or carrier and projecting from it at right angles, with braces for supporting them, which bear upon the belt while in a straight line, but which are not attached to the belt, so they will allow the latter to bend in going around the drums.

FOLDING CHAIR.—Francis B. Fabri, New York city.—This invention relates to a new construction of folding chair. The chair seat is pivoted by projecting lugs or pins to the side bars of the chair back. The lower ends of the side bars of the chair back are pivoted to the supporting legs. These legs are at their upper ends provided with projecting hooks or pins that enter longitudinal grooves in the under side of the chair seat, and bear, when the chair is in position for use, against the front ends of such grooves. The legs stand inclined, thus providing, together with the back, double converging supports for each side of the seat, and are braced by short standards. When the chair is to be folded together, the back is swung on the pivot in line with the legs. The hooks are thereby withdrawn from the grooves, liberating the seat, which can be folded against the legs. Finally, the standards are also folded against the legs.

MANUFACTURE OF WROUGHT IRON.—Pierre Eymard Jay, St. Jean Baptiste, Canada.—This invention relates to an improved process of treating cast iron of all qualities for converting it into wrought iron, the same consisting in the addition of certain proportions of nitrate of soda, oxide of manganese, and oxide of iron to a mass of melted cast iron, and in the employment of a blast of atmospheric air impinging on the surface of the liquid metal during the time it is being subjected to the intense chemical and mechanical action of the ingredients specified. The result is that the sulphur, phosphorus, and arsenic are eliminated along with the carbon, leaving the iron in an approximately pure state, and forming a scum upon the surface of the melted iron, which, upon cooling, becomes scoria or slag. The function of the blast is mainly to separate or so act on this scum as to enable the sulphur to evaporate freely.

MANUFACTURING CAST IRON.—Pierre Eymard Jay, St. Jean Baptiste, Canada.—This invention relates to the combination of slag (the residue of the burning of cast iron with oxide of manganese, nitrate of soda, and oxide of iron), with iron ore placed in a furnace, to be converted by heating into cast iron. The invention also relates to the employment of an air blast pipe connected with the upper part of the furnace, so as to blow down on the liquid metal the gases arising from the ore, and also exert a certain degree of atmospheric pressure on the metal.

BREAST STRAP FOR HORSES.—Charles P. Holmes, Gouverneur, N. Y.—The invention consists in forming a stiffener for the inside of flexible breast straps, out of several metallic plates or strips hinged together so that the breast strap will be flexible and may adjust itself easily to the various sizes of shoulders in different horses without changing the points of bearing thereon.

MIXING SPOON.—William S. Clarke, Ishpeming, Mich.—This invention has for its object to furnish an improved spoon for preparing medicines, mixing drinks, and for other purposes, and it consists in the spoon made with a projection upon the lower side of its point, and either with or without perforations in the side parts of its bowl. In using the spoon it is placed upon the edge of the tumbler or other vessel, the sugar or other substance is placed in it, and the water or other liquid allowed to run upon it; or the medicines or other liquids to be mixed are dropped or poured into it one or more at a time, as may be desired.

DUMPING WAGON.—Edward Williams and Adolphus Kinney, Potosi, Wis.—This invention relates to wagons constructed so that the contents or loads may be discharged at once and in a mass; and it consists in a sliding bar and a lever for dropping the bottom, and in a lever for raising the bottom after the load has been discharged. The driver has the means within his reach for raising or replacing, as well as dropping, the bottom.

PORTABLE GATE POST.—William A. Dillon, Middletown, Mo.—This invention has for its object to furnish an improved gate post which shall be so constructed as to be portable and not allow the gate to sag. The lower end of the main post is framed into or otherwise secured to the ground sill, which is placed upon the ground in line with the gate when closed, and the inner end of which, in the case of the rear or hinge post, projects to serve as a step for the gate to be pivoted to. A cross sill is halved to the sill, a little in the rear of the lower end of the post. The side braces are secured to the outer ends of the cross sill and to the opposite sides of the main post. The rear braces are secured to the opposite sides of the rear end of the main sill, and to the opposite sides of the post. The braces are connected by a number of rounds to receive the ends of the rails or boards of the fence, the weight of which will overbalance the weight of the gate, and thus prevent it from sagging. Upon the upper end of the main post is formed a tenon, which enters the slot of the cap, the inner end of which projects fo the gate to be pivoted to, and which is adjustably secured in place by a wedge driven through the outer part of said slot along the outer side of the post. The cap is prevented from rising by a pin.

CAR COUPLING.—Thomas P. Clines, Louisville, Ky.—This invention relates to a new attachment to cars which are provided with ordinary link and pin couplings; and has for its object to permit the raising the links in position to fit the approaching drawheads without exposing the attendant to injury between the cars. The invention consists in hanging said bar in slotted ears so that it may yield back when caught between the drawhead, and thus be preserved from being bent out of shape.

APPARATUS FOR MOLDING BUNG BUSHES.—James More, New York city.—This invention has for its object to furnish an improved apparatus for molding bushes for the bungs of casks and other vessels, said bushes being made with a wood screw thread upon their outer surfaces, to enable them to be screwed into the bung hole. It consists in the employment of leading screws for withdrawing the screw patterns from the sand, and in the employment of match plates for molding the screws and the cores and flanges of bung bushes concentrically in two half flasks.

LATHE.—Hezekiah T. Nickerson, Atchison, Kansas.—This invention relates to an arrangement of levers, knives, and springs, forming an improved attachment to a wood turning lathe for turning balusters, bedstead posts, and other analogous articles. The carriage slides on two rails, which constitute the top of the lathe frame. The wood to be turned is held in the two head stocks in the ordinary manner, and fits through a hole in the carriage. To the carriage is rigidly affixed a knife for cutting the wood down to the requisite diameter. Knives are pivoted to the carriage, and provided with handles, respectively, and with springs. These springs hold the pivoted knives away from the wood. To the carriage is also pivoted a catch to lock it in notches, which are cut into one of the rails. As the carriage is fed along the rails it is locked by the catch or catches in the successive notches, and whenever it is so locked one of the pivoted knives is swung against the wood to impart to it the desired shape at that place. In this manner the wood can be quickly shaped with a proper degree of smoothness and very exact, and a great saving effected on the ordinary method of turning.

© 1873 SCIENTIFIC AMERICAN, INC.

TO INVESTORS.

To those who wish to reinvest January Coupons or Dividends, and those who wish to increase their income from means already invested in other less profitable securities, we recommend the Seven-Thirty Gold Bonds of the Northern Pacific Railroad Company as well secured and unusually productive.

The bonds are always convertible at Ten per cent. premium (1.10) into the Company's Lands at Market Prices. The rate of interest (seven and three-tenths per cent. gold) is equal now to about 8¼ currency—yielding an income more than one-third greater than U. S. 5-20s. Gold Checks for the semi-annual interest on the Registered Bonds are mailed to the Post-Office address of the owner. All marketable stocks and bonds are received in exchange for Northern Pacifics on most favorable terms.

JAY COOKE & CO.,
New York, Philadelphia, and Washington,
Financial Agents Northern Pacific R. R. Co.

Business and Personal.

The Charge for Insertion under this head is **$1** *a Line.*

Wanted—A second hand Cross Feed Lathe, any length of bed, from 18 to 30 inch swing. Address T. P. R., P. O. Box 672, N. Y.

Don't buy a gun till you have sent to the Great Western Gun Works, Pittsburgh, Pa., for their price list. Every thing in the gun line at remarkably low prices.

Patent right for sale—Self-acting Wagon Brake. Address Hugh Davidson, Pineville, Pike Co., Ill.

Iron Ore Crusher Jaws and Plates, Quartz Stamps, &c., cast to order by Pittsburgh Steel Casting Company. All work warranted.

Special attention paid to Hammering or Trueing of large Circular Shingle Saws. Also, Retoothing. Address J. Tattersall, 26 Carroll St., Elmira, N. Y.

For Sale, Cheap—Two new 80 horse and 150 horse return tubular steam boiler. One smoke stack 44 inches in diameter, 50 ft. long. Address Frick & Bowman, Waynesboro, Franklin Co., Pa.

Manufacturers of Cotton Seed Oil Machinery, please send cut and price list to Meneilley & Volle, Calvert, Robertson Co., Texas.

A Superior Printing Telegraph Instrument (The Selden) for Private Use, furnished by the undersigned on favorable terms. It is simple, reliable, and not liable to get out of order—has already been extensively introduced. Telegraph lines also constructed on the most advantageous terms. For particulars, apply to Merchants Manufacturing and Construction Co., 50 Broad Street, New York (Rooms 12, 13 & 14). P. O. Box 6865.

For Sale or Lease—Splendid Brick Factory, 30x75—3 Stories and Basement; very substantial, light and airy. Foundry, 25x75—20 Horse Engine, Cupola, Shafting, &c. Lot, 100x100, 25 minutes from Broadway, N. Y. For particulars, call at or address "Factory," corner Tenth and Grove Sts., Jersey City, N. J.

Owners of Patents, or others who wish to contract for the manufacture of light articles or machines (those chiefly of wood preferred), will please address S. W. Richardson & Son, Medway, Mass.

"Minton & Co.'s Tiles," by appointment, Gilbert Elliott & Co., Sole Agents, No. 11 Clinton Place, 8th St., New York.

Gear Wheels for Models. Illustrated Price List free. Also Materials of all kinds. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

English Patent—The Proprietors of the "Heald & Cisco Centrifugal Pump" (triumphant at the recent Fairs), having their hands full at home, will sell their Patent for Great Britain, just obtained. A great chance for business in England. Address Heald, Sisco & Co., Baldwinsville, N. Y.

For the best Presses and Dies and all Fruit Can Tools, apply to Bliss & Williams, 118 to 120 Plymouth St., Brooklyn.

Painters and Grainers now do their best graining quickly with perforated Metallic Graining Tools. Address J. J. Callow, Cleveland, Ohio.

American Boiler Powder, for certainty, safety, and cheapness, "The Standard anti-incrustant." Am. B. P. Co., Box 797, Pittsburgh, Pa.

For Circular of Surface Planers and Patent Miter Dovetailing Machines, send to A. Davis, Lowell, Mass.

Langdon Adjustable Mitre Box, with 18, 20, 22, or 24 inch Back Saw. Address D. C. Rogers, Treasurer, Northampton, Mass.

Scale in Boilers. I will Remove and prevent Scale in any Steam Boiler, or make no charge. Send for circular. Geo. W. Lord, Philadelphia, Pa.

Gauges, for Locomotives, Steam, Vacuum, Air, and Testing purposes—Time and Automatic Recording Gauges—Engine Counters, Rate Gauges, and Test Pumps. All kinds fine brass work done by The Recording Steam Gauge Company, 91 Liberty Street, New York,

Dobson's Patent Scroll Saws make 1100 strokes per minute. Satisfaction guaranteed. John B. Schenck's Sons, 118 Liberty St., N. Y.

The Berryman Manuf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Hydraulic Jacks and Presses—Second Hand Plug Tobacco Machinery. Address E. Lyon, 470 Grand St., New York.

Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

Heydrick's Traction Engine and Steam Plow, capable of ascending grades of 1 foot in 3 with perfect ease. For circular and information, Address W. H. H. Heydrick, Chestnut Hill, Phila.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

T. R. Bailey & Vail, Lockport, N. Y., Manf Gauge Lathes.

Peck's Patent Drop Press. For circulars, address the sole manufacturers, Milo, Peck & Co., New Haven, Conn.

Williamson's Road Steamer and Steam Plow, with rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and reset by J. Dickinson, 64 Nassau St., New York.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A six foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable, W. D. Andrews & Bro. 414 Water st. N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies & all can tools. Ferracute Mch. Works, Bridgeton, N. J.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 125 pounds, are now being made at Colt's Armory, Hartford, Conn.

A New Machine for boring Pulleys, Gears, Spiders, etc. etc. No limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co.

Always right side up—The Olmsted Oiler, enlarged and improved. Sold everywhere.

Wanted to purchase, six good second hand Milling Machines, two extra heavy. Address P. O. Box 2258, New Haven, Conn.

ANSWERS TO CORRESPONDENTS

A. S., of Richmond, Va., says: What are your ideas concerning a cupola, consisting of a cylinder within another, the space between sealed at either end, having a pipe entering at top and a smaller opening at bottom, with a stream of cold water running through, keeping the space between these cylinders filled, and doing away with bricking altogether, the blast to enter as in any other cupola? Again, can you give me some method of mixing plaster of Paris, so as to increase its strength, that it may be worked into patterns, etc., or any new composition suitable for such uses? Answer: We should fear that your water backing would chill the metal and also cause a greater expenditure of fuel. Try mixing your plaster of Paris with good hydraulic cement, using as little water as may be possible, molding quickly, and leave to set just as long as possible. We hope to hear much, in the future, from our Virginia "Birmingham" whose facilities for manufacturing are hardly surpassed on our continent.

P. C. N. asks: Can an ice boat, with no other driving power than the wind, acquire greater velocity on the ice than the wind by which it is driven, allowing the wind to blow from any direction, and regardless of the relative position of the ice boat to the wind? Answer: Yes. Theoretically an ice boat sailed on a proper angle to the wind will make more than double the velocity of the wind, and in practice this velocity is approached but not wholly realized, owing to the friction and imperfections of make. When an ice boat sails directly before the wind it will move with the same velocity as the wind minus the friction of the boat on the ice. But when the boat is sailed at the proper angle to the wind, a constant pressure is maintained on the sails, and the velocity of the boat increases until its resistance equals the wind pressure on the sails. It is on the same principle that the extremities of the arms of a windmill are made to travel faster than the wind by which they are driven.

J. T. W. asks: Why is it that it is always darker just before the break of day than it is one hour previous? Answer: It is not darker just before the break of day.

Querist says: 1. On page 387, last volume, is an illustration of a button hole cutter which you say was "suggested" by H. Walker, of London, etc. This article was evidently patented, as well as "suggested," by somebody, more than a year since. One of your readers here infers from your mention that this is a British patent; I think it an American patent. Who is correct? Upon the decision pends a year's subscription to your paper at a news dealer's. Answer: The description was copied from an English paper, and is only an example of the way in which Yankee contrivances are gobbled up on the other side of the Atlantic. The device in question is the invention of John G. Howell, of Philadelphia, Pa., and was patented in this country May 9th, 1871.—2. On page 385, same issue, is an account of a torpedo craft, the dimensions of which are stated to be "about thirty feet long and three inches wide." Into this queer craft must go "motive power, machinery, electrical apparatus, explosive shells, and 500 lbs. of powder or nitro-glycerin, etc." As stevedores, we are entirely at sea over this statement in our favorite journal. Answer: Read it three *feet* wide instead of three inches, and return to the solid land.—3. The article of Van Bibber in same issue relative to the dangerous properties of bisulphide of carbon rather disconcerted us, as we had been innocently and extensively sniffing at a bottle of the "fragrant" which he so condemns. We shall give it a wider berth hereafter.

J. C. says: There are two boilers supplying steam to an engine 18 x 28, running about 80 revolutions to the minute at 75 or 80 lbs. to the inch. The boilers are 50 inches by 14 feet, with 55 three inch flues in each shell, five sixteenths of an inch thick. They are connected on top by a drum, 20 inch diameter, size of connections 4½ inches; they are not connected at the bottom, and are fed by separate pumps, and have no mud drum. They are cleaned out once a week, and burn 70 or 80 bushels of Ohio coal per day. They have about 50 square feet of grate surface. The grates are set 14 inches from the boilers and run up to 12 inches at the bridge wall, and up to within 4 inches at the smoke box. They had not been in use five months when the plates started a crack from the edge to the rivet holes, then across between the holes in the first joint, and the rivet holes in the second joint began to leak badly. In order to put on a patch, there were 4 flues taken out, 2 out of each boiler; they were put back in their places after the patch was put on, when, on firing up and running two days, they stripped the beard off of two of the flues. What is the matter with the boilers? Answer: Such cases are difficult to decide upon without personal knowledge of all the circumstances affecting them. We suspect that the effect described is due to the expansion of metal over a hot fire and covered on its inner side, possibly, with earthy deposit, and to its contraction when the feed water is forced in. Put in mud drums and a feed water heater, and thus avoid this alternate expansion and contraction as far as possible. Such an action is a frequent cause of disastrous explosions, and the boilers described are, probably, very likely to furnish another example. To leave the cause of danger undetermined would be criminal.

J. T. asks: How are the sizes of governor balls determined, for governors intended for different horse power engines, after the number of revolutions and hight of the cone in which the arms must revolve are determined? I think, without such a rule as this, the rules for finding hight of cone and number of revolutions are mere fallacies, because I think it is possible for the balls to be so light that they would not shut the valve at all; and if it is, it is also possible for them to be too large, requiring too much power to drive them. All our celebrated engineers talk about governor balls resembling the pendulum of a clock; if this is so, take the pendulum of a clock off and put a heavier one on, and it will lose time, put a lighter one on and it will gain time, proving the rule I ask for. Answer: The proper size of balls for the fly ball governor can usually be determined only by experiment. The resistances offered by different valves and connections vary so greatly that there can be no reliable general rule. The rules for determining the hight of cone are reliable and their use is indispensable in designing governors. The difference in the power required to drive a governor with heavy or with light balls is principally due to difference in the amount of friction and, usually, is an exceedingly small percentage of the power of the engine. Many of our best engineers prefer a pair of small balls (driven at a high speed, and weighted down to the proper hight of cone by a weight on the spindle) to a pair of larger balls running at their ordinary speed.

D. L. M. asks: What is the cause of the loud humming or rolling noise heard on telegraph wires? Is it caused by the electricity in despatching messages, or by spontaneous electricity, or is it caused by the wind? The sound is heard when it is wind-still and also at night when no operators are on the line. Answer: The sound is caused by the wind. A very gentle breeze will produce it. The principle is the same as that involved in Æolian harp, which produces musical sounds on being placed upon a window sill so that an air current will pass over the strings.

E. M. asks: What difference of pressure per square inch will there be (at the end of the stroke) in two air cylinders, both being forced by the same pressure of steam, one cylinder being 12 inches in diameter and the other 6 inches, both pistons working to within one sixteenth of an inch of the cylinder head? I believe the pressure in both cases would be the same per square inch; my friend thinks the pressure would be the greater in the larger one; which is right? Answer: The pressure would be the same in each cylinder.

W. G. B. says: As it is not the design of your paper to take sides with those in error, I must be allowed to criticise your decision on the balance wheel question, page 394 of Volume XXVII. R. says a balance wheel (which is always a heavy wheel) may be keyed on to a shaft at an angle of 45° and run fast without affecting the steadiness, except from its resistance to the air. You admit the tendency of the wheel is to turn itself at right angles with its axis. In other words, one side of the wheel will pull its end of the shaft one way, and the other side will pull its end the other way, which would be equivalent to two pulleys, of a certain weight and certain distance apart, with the weight of one all on one side of the shaft and the weight of the other all on the opposite side. I will give you a case in point, which may be a hint to some who have pulleys to balance. I once saw a binder pulley which shook so when running at a high speed, whether in contact with the belt or not, that it was always working its fastenings loose. It was only a ten inch pulley, with eight or nine inches face, and in the very best of standing balance; but instead of running still and smooth, as a properly balanced pulley ought, it kept up a vigorous rattling and shaking. The trouble was that, at one end of the pulley, the rim was twice as thick on one side as on the other, and the person who balanced it put his counter weight in the other end, making both ends out of balance, though they balance each other when standing still. Answer: W. G. B. is right. He is referred to the reply to S. W. H., in last week's paper, on same subject, and to an editorial in this issue, which will, we think, dispose of the subject satisfactorily.

J. A. K., of Allegheny City, Pa., is desirous that we should understand that that illustrious municipality is not a part and parcel of the neighboring village of Pittsburgh. It is his firm belief that the Observatory will remain in Allegheny, notwithstanding the puny efforts of the smoky Pittsburghians to gobble it up. Allegheny has a population of 60,000.

A. J. S. asks: What is, in your opinion, perpetual motion? If a machine is so constructed as to furnish its power and run with no other obstruction than the friction while running, is that perpetual motion or self motive power? Answer: Such a machine as you describe, we should style a perpetual motion. Many forms of perpetual motion machines have been invented. The simplest form is the tub. When a man places himself in a tub and by a steady pull at the handles lifts himself from the ground, then he has produced a successful perpetual motion. All such machines necessarily operate on the same principle, and, until an individual is enabled to operate the simple form above described with success, it will be useless for him to expect that he can work a more complicated perpetual motive machine. The addition of cog wheels and levers will not help the matter.

S. Y. O. asks if adding to the running weight of a clock will cause it to gain time, every thing else being equal? Can the action of the verge on the pendulum be made to quicken its vibrations by thus adding to its power? Of course we might apply enough power to drive the pendulum independent of gravitation. Another question is: If it takes a force of one pound to run a balance wheel at a given rate, what would be the effect of the application of a force of two pounds? I say that in order to double the motion, the power must be quadrupled. Consequently the balance wheel would only move at about one third greater speed. Answer: The escapement of a clock may be so constructed as to cause its effort to turn, under the impelling action of the weight, to accelerate the motion of the pendulum, and it is frequently, probably generally, so made. The effect is very slight, however, and the intention is, we presume, rather to make it certain that the verge shall not retard the motion of the pendulum than to secure a means of increasing the rate. The balance wheel question can be most satisfactorily decided, by the parties interested, by experiment.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 17, 1872,

AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

Annunciator, O. Hagendorf	134,058
Balcony, portable, E. Balmforth	133,962
Bale tie, J. W. Gurley	134,052
Basket, H. C. Jones	133,941
Bed bottom, D. P. Mahan	134,079
Bed spring, E. Krieghoff, (reissue)	5,189
Bed lounge, S. Kennedy	133,992
Bedstead, folding, T. S. Thorson	134,111
Bedstead, invalid, H. A. Scott	134,008
Bedstead, sofa, C. F. Fauchert	134,016
Bird cage, Osborn and Drayton	134,094
Boiler, wash, Tinner and Tregear	134,017
Boiler, culinary, J. Bowlin	133,918
Boiler for steam heater, P. Estes	134,044
Bolt trimmer, W. Dunlop	133,972
Book, hand rest for, W. F. West	134,116
Boot and shoe heel, N. Mole	134,087
Boot heel, elastic, T. P. Monzani	134,088
Boot last, nailer for, G. McKay	134,083
Boot jack, J. A. McKinstry	134,084
Boot moccasin, J. J. Drown	134,041
Boring machine, J. W. Shaw	134,009
Bottle stopper, J. B. Barsaloux	133,915
Bottle tube, sauce, J. B. Lyon	133,947
Box, fare, W. H. McLellan, (reissue)	5,194
Box machine, B. E. Dexter	134,039
Bracelet, W. W. Knapp	133,943
Brush, paint, L. A. Lightenhome	133,996
Bustle, S. Smith	134,010
Butts, finishing, E. C. Blakeslee	134,029
Candlestick, safety, T. A. Washburn	134,113
Can holder, R. J. Tanner	134,015
Car axle box, W. G. Beattie	134,026
Carbureter, J. B. Terry	133,957
Car coupling, E. W. Barker	133,963
Car coupling, D. J. Tittle, (reissue)	5,191
Card holder, P. B. Groat	134,051
Carpet beater, J. Hothersall	134,059
Car spring, J. B. Quirk	133,952
Car, street, W. H. T. Hughes	134,060
Cartridge, D. C. Farrington	133,929
Churn, J. W. F. How	133,940
Churn, J. Rengel	134,100
Cigar cutter and holder, J. Brady	134,030
Clothes washer, W. H. Nice	134,000
Coal scuttle and sifter, C. McCleaver	134,081
Cock, compression, A. Pearce	134,095
Cock, gage, N. Ray	135,098
Cooler and stand, G. Giebrich	133,979
Cooler, W. A. Jones	133,990
Cooler, milk, W. Eaton	134,043
Copy holder, L. G. Davis	134,036
Cultivator, F. Reese	134,099
Curtain fixture, W. R. Cole	133,921
Ditching machine, L. W. Fisher	133,974
Drill adjuster, well, J. Gallagher	133,977
Dyeing, Jarosson and Müller Pack	134,066
Dyeing, F. Lamy, *jils*	134,076
Egg carrier, A. H. Bryant	134,031
Elbow, sheet metal, H. S. Hoeller	133,989
Engine, hydraulic, J. H. and R. W. Welch	134,115
Engine, rotary, J. McGowan	134,082
Engine, stationary, C. S. Crane	133,926
Engine coupling, fire, D. J. Tapley	134,110
Faucet, protected, P. A. Schwarz	134,102
Ferrule machine, W. L. Newsham	134,092
File, portable, C. A. Cook	133,923
Filter, C. C. Savery	133,953
Fire arm, J. F. Swinburn	134,014
Fire arm, cartridge for, P. Giffard	134,048
Fire extinguisher, A. J. Sparrow	134,107
Fire extinguisher, B. T. Babbitt	134,024
Fire kindler, E. Everett	133,973
Fruit basket, L. W. Beecher	134,027
Fruit corer, O. W. Alexander	133,914
Furnace, hot air, C. White	134,118
Gas, illuminating, T. G. Springer	134,108
Gas, illuminating, T. G. Springer	134,109
Gas retorts, charging, A. F. Havens	134,055, 134,056
Gate, E. B. Whitaker	133,960
Gate, farm, C. E. Gillespie	133,980
Glass press, W. C. King	134,070, 134,071
Glove, J. I. McMartin	133,998
Grain binder, J. H. Morse	134,089
Gum, chewing, N. Wood	134,022
Harvester cutter, H. Mewes	134,085
Harvester dropper, W. H. Forker	133,933
Harvester, rake for, M. K. Church	133,966
Hat, G. Johnson, (reissue)	5,188
Hat, felt, J. T. Waring, (reissue)	5,192
Heater, water, J. S. Woolsey	134,120
Heater, steam, J. C. Kilgore	133,942
Hoe, S. H. Folsom	133,932
Hoe, garden, C. Belden	134,028
Hoisting machine, S. Van Emon	134,019
Household tool, H. R. Ives	134,064
Injector and ejector, W. B. Mack	133,997
Iron and steel refining, N. B. Hatch	133,937
Jack, lifting, W, A. Middleton	134,086
Jack, lifting, J. D. Otstot	133,949
Jar for candy, W. C. King	134,072
Knife and fork, W. D. Smith	134,011
Knife, fruit, H. Soggs	134,106
Lamp chimney holder, J. H. Irwin	134,063
Lifter, track, L. Grover	133,934
Lime kiln, C. B. Corey	133,925
Lock, J. Keath	133,991
Lockets, die for basils of, H. Henrich	133,986
Logs, turning, E. C. Dicey, (reissue)	5,187
Loom shuttle, Ladd and Henderson	134,074
Loom shuttle, P. A. Lambert	134,075
Medical compound, T. Copeland	133,924
Metal ware, die for, M. Bray	133,919
Milk, transporting, J. A. Whitney	134,020
Mill, smut, C. Küderli	133,998

© 1873 SCIENTIFIC AMERICAN, INC.

Miningapparatus, F. H. Fisher, (reissue)	5,198
Motion, converting, T. D. Larkin	133,994
Motion, rotary, D. F. Mosman	133,999
Musical index, J. L. Ober	134,001
Nail machine, M. and D. Hain	133,935
Organ bellows, H. W. smith	134,104
Organ case, G. Woods	134,023
Packing case, L. Selling	134,103
Pans, making, W. Fogelsong	133,975
Paper and cloth, uniting, G. K. Snow	134,105
Paper bags, making, B. Cole	134,035
Parer and corer, apple, H. S. Leonard	134,078
Pavement, E. Gomez	134,049
Pavement, H. A. Lacey	134,073
Pavement, A. Wanner	134,112
Piano printing attachment, G. Heydrich	133,987
Pile driver, Hall and Badger	133,936
Pipe cutter, R. S. Sanborn	134,007
Pipe, fish guard for, A. R. Young	134,122
Pitman, S. Wheeler	134,117
Planter, corn, C. Busch	134,032
Planter, cotton, F. E. Habersham	133,983
Plow, sulky, J. Worrell	134,121
Press, cotton, J. T. Williams	134,021
Press, hay and cotton, J. B. Pugh	134,097
Printing press, J. Watson	133,959
Printing press, etc, E. L. Ford	133,976
Pulley, Hummer and Stover	134,061
Pump, J. Bean	134,025
Pump, Soward and Dykeman	133,955
Pump, oil, A. P. Odell	134,093
Pump, ship's, S. F. Paullin	133,950
Pump, steam jet, J. D. Toppin	134,018
Pyroxylin, etc, Deitz and Wayne	133,969
Railway water column, R. T. H. Stileman	134,013
Rake, horse hay, G. E. Burt	133,920
Rake, horse hay, D. Z. Lantz	133,944
Refrigerator, E. L. Allen	133,961
Roofing felt, preparing, G. W. Pond	134,062
Rope, making, H. Greenway	134,050
Sash fastener, R. E. Beckwith	133,916
Saw mill, W. S. Colwell	133,922
Saw mill, block for. C. Leddell	133,995
Saw setting device, A. Greeley	133,982
Saw sharpening swage, Hinds and Howe	133,988
Sawing machine, B. C. Chambers	134,033
Scale and platform, J. Cobleigh	134,034
Scraper, cotton, C. Marsh, Jr	134,080
Sawing machine, J. A. House	133,939
Sewing machine, D. E. Rice	134,101
Sewing machine, R. Whitehill	134,119
Shaft coupling, W. W. Crane	133,967
Shingle machine, N. H. Bolton	133,964
Shuttle box motion, B. H. Jenks	134,069
Shutter fastening, S. Mowry	134,090
Side stick and quoin, T. McGrath	133,948
Signal light compositions, N. J. Holmes	134,058
Skates, B. Geiger	134,047
Smelting gold, etc., W. O. Davis	133,927
Sockets, forging metallic, Fitch & Shaffer	134,045
Spark arrester, etc., Hawkes and Paine	133,984
Spark arrester, R. D. Grant	133,981
Spinning frame, B. H. Jenks	134,067
Spinning ring, B. H. Jenks	134,068
Spoke machine, N. H. Davis	134,037
Spring for furniture, W. T. Doremus	133,971
Spring seat, W. T. Doremus	133,970
Steam generator, D. Renshaw	134,003
Seamer, culinary, H. J. Gale	134,046
Steel converter, A. L. Holley	133,938
Stove drum, T. F. Hamilton	134,054
Stove heating, E. M. Deey	133,928
Stove, reservoir for, Waters and Lascell	133,958
Stove polish, J. W. Birch	133,917
Telegraph, electro magnet, W. E. Davis	133,968
Thrashing machine, J. T. Watkins	134,114
Ticket printing, J. Dyer	134,042
Toy spring gun, M. Ferrant	133,930
Trap, fly, J. Fletcher	133,931
Tube clasp, E. A. Day	134,038
Tubing, welded, S. P. M. Tasker (reissue)	5,190
Valve and strainer, J. Large	134,077
Vault cover, J. K. Ingalls	134,062
Vehicle brake, W. A. Pier	134,096
Vehicle, pleasure, C. W. Saladee	134,004
Vehicle, pleasure, C. W. Saladee	134,005
Vehicle pring,s C. W. Saladee	134,006
Veneer cutting machine, C. W. Spurr	134,012
Wagon brake. G. W. Jackman	134,065
Warp setting frame, J. W. Higgins	134,057
Washing machine, A. Haynes	133,985
Washing machine, Spangler and Reich	133,956
Watch key, B. A. Lewis	133,945
Water wheel, E. Dougherty	134,040
Wheels, polishing, F. W. Gesswein	133,978
Wheels, setting boxes in, J. A. Newell	134,091
Whip lash and snap, E. B. Light	133,946
Wire fabric, weaving, D. J. Powers	133,951
Wire, etc., scouring, G. Broomhead	133,965
Writing fluid, N. P. Slade	133,954

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

23,291.—METALLIC BALE BAND.—G. Brodie. March 5, 1873.
23,396.—STOVE.—H. R. Robbins. March 12, 1873.
23,643.—BELT DISINTEGRATOR.—J. F. Greene. March 26, 1873

DESIGNS PATENTED.

6,286 & 6,287.—CARPETS.—J. H. Bromley, Philadelphia, Pa.
6,288 to 6,290.—CARPETS.—R. R. Campbell, Lowell, Mass.
6,291 to 6,294.—CARPETS.—J. M. Christie, Brooklyn, N. Y.
6,295 & 6,296.—CARPETS.—J. Hamer, Lowell, Mass.
6,297 & 6,298.—CARPET.—H. S. Kerr, Philadelphia, Pa.
6,299 to 6,301.—CARPET.—D. McNair, Lowell, Mass.
6,302.—BOOK COVER.—C. F. Metzger, New York city.
6,303, & 6,304.—CARPETS.—C. Righter, Philadelphia, Pa.
6,305.—PARLOR STOVE.—R. Scorer and R. Ham, Troy, N.Y.
6,306 to 6,311.—STOVES.—N. S. Vedder, Troy, N. Y.
6,312.—RANGE.—N. S. Vedder, F. Ritchie, Troy, N. Y.
6,313.—COOKING STOVE.—N. S. Vedder, F. Ritchie, Troy.
6,314 to 6,317.—STOVES.—N. S. Vedder, F. Ritchie, Troy, T. Heister, Lansingburg, N. Y.
6,318.—RANGE.—A. J. Gilbert, New York city.
6,319.—WASH STAND.—J. R. Lancaster, Morrisania, N. Y.

TRADE MARKS REGISTERED.

1,082 & 1,083.—HAMS, ETC.—R. Beresford & Co., Cincinnati.
1,084.—PAINTERS' SUPPLIES.—E. D. & W. A. French, Camden, N. J.
1,085.—BAKING POWDER.—Steele & Price, Chicago, Ill.
1,086.—FELTING.—Salamander Felting Co., Troy, N. Y.
1,087.—DECRUSTATOR.—J. T. Tyler, Wheeling, W. Va.
1,088.—COFFEES.—Zoll.r & Little, Baltimore, Md.

VALUE OF PATENTS,

And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20), or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, New York, who will give prompt attention to the business and furnish full instruction.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,00,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors 37 Park Row, New York.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information and for pamphlets of instruction and advice

Address

MUNN & CO.,
PUBLISHERS SCIENTIFIC AMERICAN,
37 Park Row, New York.

OFFICE IN WASHINGTON—**Corner F and 7th streets,** opposite Patent Office.

Advertisements.

RATES OF ADVERTISING.

Back Page - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement as the letter-press.

RUBBER STAMPS, Steel Letters, the Little Gem, Stencil Dies, &c., U. S. M'F'G Co., 97 W. Lombard St., Baltimore. $10 a day to Agents.

SAFETY FUSE Best quality, Cotton, Hemp, and Water proof. Manufactured by F. M. ALFORD, Avon, Conn.

Purchasers of Saw Mills

are notified that we have commenced suits in the U. S. Circuit Courts against COLE, BUGBEE & Co., Lebanon, N. H., LUKE BUZZELL, St. Johnsbury, Vt., and F. C. CANDEE & Co., New York, (selling agents of Belknap, Ely & Co., Northfield, Vt.) for infringements of patents granted Dennis Lane for improvements in Circular Saw Mills. The public is cautioned against buying Mills or Set Works manufactured and sold by the above named parties, or any other, in violation of our rights, as we shall prosecute infringers to the full extent of the law, and hold purchasers of infringing Mills or Set Work responsible for the use of the same.

Our patents cover improvements in head-blocks generally, setting devices, dogging devices, tapering devices, and frictional set works.

Descriptive pamphlets sent to any address, and copies of Lane's patents furnished upon request.

LANE, PITKIN & BROCK,
Montpelier, Vermont.

MANNING'S BOLT CUTTER, Power or Hand. Price, including Taps and Dies Cutting Bolts ¼" a 1¼", 9 sizes, $130. Counter Shaft with Cone Pulley, $35. Send for circular to H. L. MANNING, Man'f'r, 113 Liberty St., N. Y. Agents, W. L. Chase & Co., N. Y.; Reed & Bowen, Boston; Hitchcock & Walker, Chicago; Gaff, Gray & Gordon, Cincinnati; Kelley, Howell & Ludwig, Philadelphia.

LATHE CHUCKS—HORTON'S PATENT from 4 to 36 inches. Also for car wheels. Address E. HORTON & SON, Windsor Locks, Conn.

A NEW NOVEL,

BY A FAVORITE AUTHOR.

"HARD TO WIN.

BY

JOHN FREDERICK SMITH,

AUTHOR OF

"MINNEGREY," "STANFIELD HALL," "AMY LAWRENCE," "WOMAN AND HER MASTER," "TEMPTATION," "THE WILL AND THE WAY," ETC., ETC.

Few writers of fiction have commanded the interest of the reading people so uninterruptedly and successfully as J. F. SMITH. His novels, almost all issued in serial form, have been read by millions on both sides of the Atlantic. His fertile imagination, dramatic construction of plot, and artistic management of his subject, afford the novel-reader all that can be desired in a pure work of fiction of the higher order, true in character, society, and descriptions, elevating in tone, and eminently interesting; equal, in fact, to any of those on which his reputation rests.

The character of Ellen Lumley is a charming creation of the novelist. Her intriguing and unscrupulous aunt, Mrs. Barton Lumley, is, unfortunately for poor human nature, a character far from impossible. The young Americans are what they should be—high-minded, full of true and noble impulses.

The flavor of the supernatural adds attractiveness to the story without shocking the probabilities or exciting distrust.

This remarkable novel will commence in

FRANK LESLIE'S CHIMNEY CORNER, No. 396.

WHICH WAS ISSUED MONDAY, DEC. 16,

with a Fine Art Supplement—"Fishing"—a beautiful steel engraving, worth $10, reproduced by photography.

FRANK LESLIE'S CHIMNEY CORNER,

with the ablest writers in the language, with artistic engravings never approached by the periodical press, is a paper that can enter an AMERICAN HOME only to exercise the best and highest influence.

The Stories are unsurpassed in a literary point of view, and the more serious topics are treated with freshness, originality, and ability.

It is a perfect encyclopædia of amusement and instruction for a family.

Subscription, $4 a year. Single number, ten cents.

Subscriptions can begin at any time, and as we begin a Serial almost monthly, the interest is always maintained.

Address subscriptions to FRANK LESLIE, 537 Pearl street, New York.

☞ Housekeepers wishing to obtain a copy of

BEETONS,

a perfect Cyclopædia of Cookery and Family Requirements, lavishly illustrated with chromo-lithographic plates and wood-cuts in the text, can have this book, which sells for $3.50, and the Chimney Corner for a year for $5, by addressing amount to

FRANK LESLIE,

537 Pearl street, New York.

Iron City and Siberian Iron Works.
ROGERS & BURCHFIELD,
MANUFACTURERS OF
Refined Charcoal and Best Bloom Sheet Iron, Brands Apollo and Siberian. Specialties: Stamping, Button, Trunk, Lock, Shovel, Tea Tray, Show Card, Tagger, and all other kinds of fine Sheet, from 12 to 40 gauge. Cut to size, as required by the trade. Equally to any imported Office and Warehouse, 108 Water St., Pittsburgh, Pa.

FOR SALE—A second hand Hewes & Phillips Steam Engine, 13 in. cylinder, 36 in. stroke; will be ready for delivery 20th Dec.; previous to which time may be seen running at the Singer Mf'g Co's Silk Mill, Bank St., Newark, N. J.

RISDON'S IMPROVED:
Turbine Water Wheel
Is Cheap, simple, strong and durable; upon a test has yielded over 86 per cent at full gate, and over 78 per cent at eight-tenths gate.
Send for circular to
T. H. RISDON & CO.,
Mount Holly, New Jersey.

NEW PATTERNS.
MACHINISTS' TOOLS—all sizes—at low prices.
E. & R. J. GOULD, 97 to 113 N. J. R. R. Ave.,
Newark, N. J.

BURDON IRON WORKS.—Manufacturers of Pumping Engines for Water Works, High and low Pressure Engines, Portable Engines and Boilers of all kinds, Sugar Mills, Screw, Lever, Drop, and Hydraulic Presses, Machinery in general. HUBBARD & WHITTAKER, 10 Front st., Brooklyn, N. Y.

WANTED
50 MACHINISTS used to first class work. Steady, reliable men can find good pay and steady work at Passaic, N. J. Address NEW YORK STEAM ENGINE COMPANY, Passaic, N. J.

© 1873 SCIENTIFIC AMERICAN, INC.

The Great American BRICK MACHINE COMPANY.

E. R. GARD, President,
53 South Jefferson Street, Chicago, Illinois.

Capital Stock, $500,000, fully paid up. Organized under the Laws of the State of Illinois, January 6, 1872.

CHALLENGE.

Having now manufactured many millions of bricks on the Great American Brick Machines, and thus tested their qualities in the fullest manner, we claim that this machine is the best before the public; and for the sake of settling the matter at rest, we now offer to all proprietors of machines for like purposes in the United States, the opportunity to *disprove it* IF THEY CAN.

We propose to give to all comers a fair chance to test the relative values of their machines with ours, at a fair competitive trial, to take place during the next brick-making season, at a time and place to be mutually agreed upon, with the following conditions: Each competitor to make and burn a kiln of from 100,000 to 500,000 bricks, and each to pay the expense of his own kiln; and the merits of the case to be decided by a disinterested committee, who shall take account of the expense of each kiln from the time the clay is first dug till the bricks are ready for market, and then decide which has made the best and cheapest bricks, publishing their decision for the benefit of the party who wins on the trial. Also that the loser (or the losers, if there be more than two competing) shall sell $1,000 worth of the brick manufactured by him (or them), and donate the proceeds to the poor of the city in which the trial is made, in such manner as may be mutually agreed upon.

Parties wishing to accept this challenge can address the president.

A machine in operation can be seen at any time during the winter season at No. 53 South Jefferson Street, Chicago; where parties desirous of purchasing machines or territory can see it tell its own story.

Any further information can be had by addressing
E. R. GARD,
53 South Jefferson Street, Chicago, Ill.

TESTIMONIALS.

E. R. GARD, Esq., President of the Great American Brick Machine Company:

Dear Sir—The Brick Machine we purchased of you about the middle of last June has given us unbounded satisfaction We have since that time made on it over one million of brick of a very superior quality, without a single break of any kind about the machine, or a single cent for repairs; and we unhesitatingly say that, in our opinion, it is the very best Brick Machine in the world. With ten men and four boys, we make with great ease twenty-five thousand brick per day.
VENEKLAASEN & BOLKS.

The following letter from Judge Fuller, Ex-Mayor of Chicago, is valuable evidence as to the quality of these brick, and their ability to stand the severest tests:

E. R. GARD, Esq., President Great American Brick Machine Company:

Dear Sir—The great fire of October 9, 1871, which destroyed so much of the great city of Chicago, has proven to my mind that your brick are far superior to any other brick in this market. I had used a large number of them in the erection of my buildings on Wabash avenue; and in those buildings were also a large number of brick of other manufacture. These buildings were in the *hottest of the fire;* and in taking the brick from the ruins, I found fifty per cent. more whole brick of your make than of any other. And when I find a brick that will stand such a *fire*, and then go through the *frost* of winter, all exposed, and come out in the spring so perfect, I think no higher recommendation for them could be asked. This is why I use your brick now in preference to any other.
Respectfully, etc., HENRY FULLER.

The following is given by a number of the most prominent builders of Chicago:

E. R. GARD, Esq.—We, the undersigned, take pleasure in bearing testimony to the excellent quality of the brick manufactured by you for the Chicago market, as we have particularly noticed their superiority over all other brick in withstanding the severest test to which they could be subjected—the great fire of Chicago, October 9, 1871. In clearing up the ruins, which had been exposed to the storms of the winter following the fire, we noticed that in all cases where your brick had been used, a far larger percentage came out of the ruins in a perfect state, than from those buildings where other brick had been employed. We consider that this fact proves conclusively that your brick stand far ahead of any other in the market, in the great essentials of strength and durability. Where others came out in the shape of bats and rubbish, yours were almost as perfect as when taken from the kiln. Firmly believing that your process of making brick is much the best we have ever known, we unhesitatingly recommend your machines to all brick makers; and assure them that they cannot do as well in any other direction. Very truly, etc.,
C. & A. PRICE,
ROBINSON & DARST,
D. F. CRILLY & BRO.,
R. H. MORGAN.

INTERESTING TO

Capitalists & Piano Manufacturers.

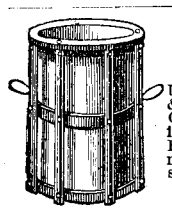
We have for negotiation the right for McGregor's Piano Action and Octave Coupler, both radical improvements on the ordinary instrument, at slight expense, and which greatly increase sales by their favorable impression upon customers. Liberal terms will be made for facilities for manufacturing and introduction, and full information can be obtained from the undersigned. A full sized instrument is on exhibition showing the effect. A large business can be based upon these patents (without fear of competition), either by those already established or by capitalists in conjunction with the inventor.

All other things being equal, a customer will prefer a piano with these improvements at the same, or even increased, price. This fact establishes a trade at once, and the cost of production being little, if any, greater, the profit and magnitude of the business is obvious.

E. E. ROBERTS & CO.,
NEGOTIATORS OF VALUABLE INVENTIONS,
15 Wall Street, New York.

AMERICAN PAPIER MACHE COMP'Y Pails and Cuspidors. No. 1 Barclay St., New York.

FOR SALE—An established manufacturing (**Wood working**) business, in one of the best towns in Iowa. Capital required, about $15,000. More can be successfully used. For particulars, inquire of
W. W. WALKER, 61 Liberty St.,
New York, Room 19.



KANE'S Patent Receptacle,

Useful in Manufactories Refineries, &c., and can also be used as an Ash Can. The inventor desires to organize a company to manufacture this Receptacle, or will grant licenses to manufacture, dispose of rights, or sell the entire patent. Address
THOS. H. KANE,
Box 11, Station C, New York City.

FOR SALE, F. L. DELFER'S Patents on Axle Nuts and Wrench. The wrench grasps the nut in a manner that it cannot slip from it, and thus it is made impossible for people to soil their hands with dirty, sticky wagon grease, in greasing a wagon. It is believed that nobody who owns a wagon or buggy will do without this kind of an axle nut. You can throw the wrench, with the nut in it, over a house and it cannot fall out. The wrench is as plain as the nut, and is adjusted in an instant. Patents just granted. I will sell both patents, in whole or State rights, on liberal terms, or give licenses. F. L. DELFER, Box 4795, New York.

12 Samples sent by mail for 50 cts., that retail quick for $10. R. L. WOLCOTT, 181 Chatham Square, New York.

BRICK PRESSES For Fire and red brick manufactured at No. 309 S. 5th St., Philadelphia. Established 1844. S. P. MILLER.

MATHUSHEK PIANO MF'G CO. The most durable pianos. The most powerful tone. The finest touch and action. The purchasers delighted. The pamphlets sent free.
New Haven, Conn.

$5 to $20 per day! Agents wanted! All classes of working people, of either sex, young or old, make more money at work for us in their spare moments or all the time than at anything else. Particulars free. Address G. Stinson & Co., Portland, Maine.

Andrew's Patents.

Noiseless, Friction Grooved, or Geared Hoisters, suited to every want.
Safety Store Elevators. Prevent Accident, if Rope, Belt, and Engine break.
Smoke-Burning Safety Boilers.
Oscillating Engines, Double and Single, 1-2 to 100-Horse power.
Centrifugal Pumps, 100 to 100,000 Gallons per Minute, Best Pumps in the World, pass Mud, Sand, Gravel, Coal, Grain, etc., without injury.
All Light, Simple, Durable, and Economical.
Send for Circulars.
WM. D. ANDREWS & BRO.,
414 Water Street, New York.

100 YEAR ALMANAC. FOR 50 CENTS we send POSTPAID an Almanac giving every Year, Month, Week and Day of the Century, also a Pocket Calendar for 1873. Extra inducements to Agents. Address
GEORGE A. HEARD & CO., Boston, Mass.

$425 Upright Engine and Tubular Boiler (4) HORSE POWER, with all Trimmings—ALSO, (10) HORSE POWER. Send for circulars. VARIETY IRON WORKS COMPANY, Cleveland, Ohio.

CINCINNATI BRASS WORKS—Engineers and Steam-fitters' Brass Work. Best quality. Send for Catalogue. F. LUNKENHEIMER, Prop.

The ARION PIANO is THE BEST!

SAVE MONEY by purchasing the best Piano-Forte. Do not decide what make to get until you write for our Illustrated Circular, which we mail free. The "Arion Piano" contains four patented improvements that make it *more durable* than any piano in the market.

Write for Circular, and mention where you saw this notice.

Address THE ARION PIANO-FORTE COMPANY, 5 East Fourteenth Street, New York City.

Machinery,

Wood and Iron Working of every kind. Leather and Rubber Belting, Emery Wheels, Babbitt Metal, &c.
GEO. PLACE & CO., 121 Chambers & 103 Reade Sts, N.Y

Machinists' Tools.

The largest and most complete assortment in this country, manufactured by
NEW YORK STEAM ENGINE COMPANY,
121 Chambers & 103 Reade Streets, New York.

Cold Rolled Shafting.

Best and most perfect Shafting ever made, constantly on hand in large quantities, furnished in any lengths up to 24 ft. Also, Pat. Coupling and Self-oiling adjustable Hangers. GEORGE PLACE & CO.,
121 Chambers & 103 Reade Streets, New York.

Sturtevant Blowers.

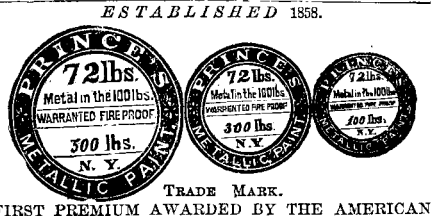
Of every size and description, constantly on hand.
GEORGE PLACE & CO.,
121 Chambers & 103 Reade Streets, New York.

WILDER'S

Pat. Punching Presses

For Railway Shops, Agricultural Machine Shops, Boile Makers, Tinners, Brass Manufacturers, Silversmiths, &c Warranted the best produced. Send for Catalogue, &c.
NEW YORK STEAM ENGINE CO.,
121 Chambers & 103 Reade

ESTABLISHED 1858.



TRADE MARK.

FIRST PREMIUM AWARDED BY THE AMERICAN INSTITUTE FAIR, 1871.

Waste no time, oil, or labor on worthless paints. Use PRINCE'S METALLIC, an indestructible coating for iron, tin and wood. Send for a circular and sample For sale by the trade, and PRINCE'S METALLIC PAINT COMPANY, **96 CEDAR STREET, New York.**

L. & J. W. FEUCHTWANGER
CHEMISTS & IMPORTERS.
ADDRESS 55 CEDAR ST. NEW YORK.
SOLUBLE GLASS & SILICATES, OXIDE OF MANGANESE FOR STEEL, GLASS & PATENT DRYERS, FLUORSPAR, FELSPAR, FLINT, NICKEL-SALTS, ASBESTOS, BLACK LEAD, METALS, &C. &C. PUBLISHERS OF TREATISES ON "GEMS," "SILEX AND FERMENTED LIQUORS."

J. H. WHITE, Newark, N. J., Manufacturer of Tin, Zinc, Brass and Copper Spun Bottom Oilers, Children's Carriage Trimmings, Cowell Pat. Door and Gate Spring, &c. &c. Stamped, Cast and Spun Metal Work, Dies, Tools, and Patterns to order.

"HOW IS YOUR HEALTH?"

If you would be well and strong, study the Laws of Life and Health by reading "THE SCIENCE OF HEALTH," the best health journal published—not the organ of any business or institution, but an independent, earnest educator of the people in all that pertains to the *preservation* and *regaining* of health. Only $3 a year, 20 cents a number, and the

ANXIOUS MOTHER,

a splendid OIL CHROMO, price $5, given to every subscriber. THE SCIENTIFIC AMERICAN and SCIENCE OF HEALTH, with CHROMO, for $4.50. Our Chromos are now READY FOR DELIVERY. If sent by mail, mounted and varnished, ready for framing, 30 cents extra must be sent for each picture. Address, at once, S. R. WELLS, Publisher, 389 Broadway, New York.

SILICATE OF SODA

Liquid Silex—Soluble or Water Glass—manufactured by L. & J. W. FEUCHTWANGER, New York.

WOOD-WORKING MACHINERY.

New and improved Woodworth's, Daniels, and Dimension Planers, Moulding, Mortising, Tenoning, Sawing, Boring, Upright Shaping Machines, etc. Machine Chisels and Augers, Moulding Cutters and **Farmer's Celebrated Patent Matcher Heads and Cutters**, constantly on hand and made to order.
R. BALL & CO., 36 Salisbury St., Worcester, Mass

WOOD AND IRON Working Machinery Gage Lathes, Cabinet Makers Machinery, Shaping Machines, Band Saws, Shingle and Stave Machinery, Band Saws, Cable and Sheaves for transmitting power Engine Lathes, Upright Drills, Key Seat Machines, etc. Illus. Catl. free. T. R. BAILEY & VAIL, Lockport, N.Y.

WHALEN TURBINE, No risks to purchaser Pamphlet sent free. SETH WHALEN, Baliston Spa, N. Y

1832. SCHENCK'S PATENT. 1871.

WOODWORTH PLANERS

And Re-Sawing Machines, Wood and Iron Working Machinery, Engines, Boilers, etc. JOHN B. SCHENCK'S SONS, Matteawan, N. Y. and 118 Liberty St., New York

WOOD-WORKING MACHINERY GENerally. Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Nos. 24 and 26 Central, corner Union st., Worcester, Mass.
WITHERBY RUGG & RICHARDSON.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided, we are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithographaddress Carnegie, Kloman & Co, Union Iron Mills, Pittsburgh, Pa.

Corrugated Iron,

Iron Buildings, Roofs, Shutters, &c.
MOSELY IRON BRIDGE & ROOF CO.,
Send for Circulars. Office, 5 Dey st., New York.

MASON'S PAT'T FRICTION CLUTCHES are manufactured by Volney W. Mason & Co., Providence, R. I. Agents, L. B. BROOKS, 60 Cliff street, New York; TAPLIN, RICE & CO., Akron, Ohio.

TO PATENTEES—Patent Rights Bought and Sold on Commission. Agents make $500 per month. Address NATIONAL P. R. AGENCY, Philadelphia, Pa.

SILICATE OF SODA

in its various forms. PHILADELPHIA QUARTZ CO.

PUNCHING AND DROP PRESSES. For the **Best** and **Cheapest** Adress THE STILES & PARKER PRESS CO., MIDDLETOWN, CONN.

HINKLEY KNITTING MACHINE

The Simplest, Cheapest, and Best in use! Has but one needle! A Child can Run it. AGENTS WANTED IN EVERY TOWN. Manf. Florence S. M. Co. Send for circular and Sample Stocking, to
HINKLEY KNITTING MACH. CO., Bath, Me.

WOODBURY'S PATENT

Planing and Matching

and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS, 91 Liberty street, N. Y.;
Send for Circulars. 67 Sudbury street, Boston.

LEFFEL IMPROVED DOUBLE TURBINE WATER WHEEL.
6000 IN USE.
NEW WHEEL BOOK 152 PAGES FOR 1872
SENT FREE
JAMES LEFFEL & CO. SPRINGFIELD, O.
& 109 LIBERTY ST. NEW YORK CITY.

BUY BARBER'S BIT BRACE.

FELT. Cheapest, best, and most durable non-conductor known. BOILER FELTING WORKS, 46 Courtlandt St., New York.

MACHINERY, NEW and 2d-HAND.—Send for Circular. CHAS. PLACE & CO., 60 Vesey st., New York

WOODWORTH SURFACE PLANERS, $125. Planers and Matchers, $350. S. C. HILLS 51 Courtlandt street, New York.

THE "PHILADELPHIA"

HYDRAULIC JACK.

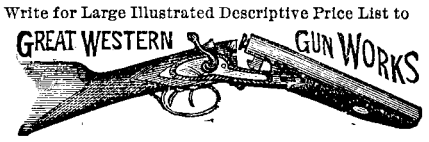
PISTON guided from both ends; all working parts guarded from dust; single or double pumps, cylinders, shafts, rocker arms, pistons, etc., entirely steel.
No. 14 N. 5th st., Philadelphia, } PHILIP S. JUSTICE.
No. 42 Cliff st., New York. }

INVENTORS' NATIONAL UNION. E. H. GIBBS & CO., 178 Broadway, New York. Patents Sold on Commission. Send for Circular.

OTIS' SAFETY HOISTING Machinery.

OTIS, BROS. & CO.,
NO. 348 BROADWAY, NEW YORK.

Write for Large Illustrated Descriptive Price List to



PITTSBURGH, PA.

Double, Single, Muzzle and Breech-Loading Rifles. Shot Guns, Revolvers, Pistols, &c., of every kind, for men or boys, at very low prices. Guns, $3 to $300; Pistols, $1 to $25.

JUDSON'S
PATENT LATHE CHUCK.

The strongest Chuck made of the same size and weight. Constructed on entirely new principles, each jaw being independent in action, and so arranged that the pressure of the screw towards the center also presses the jaw firmly against the face of the Chuck, holding the work more securely than any other Chuck now in use with the same power expended on the screw.
DWIGHT ROBERTS, Manufacturer,
Cor. Wythe Ave. & Hewes St., Brooklyn, N. Y.

PROTECTION AGAINST FIRE.

HALL BROTHERS

Are prepared to introduce their "System of Sprinklers" into Mills, Factories, &c., at short notice. Call and see a practical operation of same at their works,

36 CHARDON STREET,
BOSTON.

BUERK'S WATCHMAN'S TIME DETECTOR.—Important for all large Corporations and Manufacturing concerns—capable of controlling with the utmost accuracy the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular. J. E. BUERK,
P. O. Box 1,057 Boston, Mass.
N. B.—This detector is covered by two U. S. Patents Parties using or selling these instruments without authority from me will be dealt with according to law.

RICHARDSON, MERIAM & CO. Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines, Matching, Sash and molding, Tenoning, Mortising, Boring, Shaping, Vertical, and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty st, New York. 1*1

SHINGLE AND BARREL MACHINERY.—Improved Law's Patent Shingle and Heading Machine, simplest and best in use. Also, Shingle Heading and Stave Jointers, Stave Equalizers, Heading Planers Turners, &c. Address TREVOR & Co., Lockport, N. Y.

PORTABLE STEAM ENGINES, COMBINing the maximum of efficiency, durability and economy, with the minimum of weight and price. They are widely and favorably known, more than **900** being in use. All warranted satisfactory or no sale. Descriptive circulars sent on application. Address
J. C. HOADLEY & CO., Lawrence, Mass.
Liberty st., New York.

RIVERVIEW Military Academy, Poughkeepsie, N. Y. A thorough-going school for boys.

Niagara Steam Pump.

CHAS. B. HARDICK,
23 Adams st., Brooklyn, N. Y.

P. BLAISDELL & Co.,

MANUFACTURERS OF FIRST CLASS **MACHINISTS' TOOLS.** Send for Circulars.
Jackson st., Worcester, Mass.

Milling Machines.

STANDARD, UNIVERSAL, INDEX, CAM-CUTTING and PLAIN, in every variety, of unequalled design and first-class workmanship. Send for Illustrated Catalogue to the BRAINARD MILLING MACHINE Co., 11 Pemberton Square, Boston. Works at Hyde Park.

FOOT LATHES.—T. SHANKS, Baltimore, Md.

You ask WHY we can sell First Class 7 Octave Pianos for **$290**? We answer—It costs less than **$300** to make any **$600** Piano sold through Agents, all of whom make **100 per ct.** profit. We have no Agents, but ship direct to families at Factory price, and warrant 5 Years. Send for illustrated circular, in which we refer to over **500** Bankers, Merchants, &c. (some of whom you may know), using our Pianos, in **44** States and Territories. Please state where you saw this notice.
U. S. Piano Co., 865 Broadway, N. Y.

WOODWARD'S COUNTRY HOMES.

150 DESIGNS and PLANS for Houses of moderate cost $1.50, post paid.
ORANGE JUDD & CO.,
PUBLISHERS, 245 Broadway, N. York
☞ Send for Catalogue of all books on Architecture, Agriculture, Field Sports and the Horse

PROSPECTUS

OF THE

SCIENTIFIC AMERICAN.

The Best Mechanical Paper in the World

A year's numbers contain over 800 pages and several hundred engravings of new machines, useful and novel inventions, manufacturing establishments, tools, and processes.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the Industrial pursuits generally, and is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

To the Mechanic and Manufacturer!

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

Chemists, Architects, Millwrights and Farmers

The SCIENTIFIC AMERICAN will be found a most useful journal to them. All the new discoveries in the science of chemistry are given in its columns; and the interests of the architect and carpenter are not overlooked, all the new inventions and discoveries appertaining to these pursuits being published from week to week. Useful and practical information pertaining to the interests of millwrights and millowners will be found published in the SCIENTIFIC AMERICAN, which information they cannot possibly obtain from any other source Subjects in which planters and farmers are interested will be found discussed in the SCIENTIFIC AMERICAN many improvements in agricultural implements being illustrated in its columns.

We are also receiving, every week, the best scientific journals of Great Britain, France, and Germany; thus placing in our possession all that is transpiring in mechanical science and art in these old countries. We shall continue to transfer to our columns copious extracts, from these journals, of whatever we may deem of interest to our readers.

TERMS.

One copy, one year	$3.00
One copy, six months	1.50
One copy, four months	1.00

One copy of Scientific American for one year, and one copy of engraving, "Men of Progress" - 10.00

One copy of Scientific American for one year, and one copy of "Science Record," for 1873 - - - 4.50

Remit by postal order, draft or express.

The postage on the Scientific American is five cents per quarter, payable at the office where received. Canada subscribers must remit, with subscription, 25 cents extra to pay postage.

Address all letters and make all Post Office orders or drafts payable to

MUNN & CO.,
37 PARK ROW NEW YORK.

© 1873 SCIENTIFIC AMERICAN, INC.

Advertisements

Advertisements will be admitted on this page at the rate of **$1.00** *per line for each insertion. Engrvings may head advertisements at the same rate per line by measurement, as the letter-press.*

THE

SCIENCE RECORD

FOR

1873.

A Compendium of the Scientific Progress and Discoveries of the Preceding Year. Illustrated with Steel Plate and other Engravings. 600 pages, octavo. Price, $2.

THIS NEW AND SPLENDID BOOK will be published about January 15, 1873. Its contents will embrace the most Interesting Facts and Discoveries in the various Arts and Sciences that have transpired during the preceding year, exhibiting in one view the General Progress of the World in the following Departments:

1.—CHEMISTRY AND METALLURGY.—Embracing accounts of all the chief Chemical Discoveries, Improvements, and Processes introduced in the various Industrial Arts, with engravings. Improvements in the Processes of Working Iron, Steel, Lead, Copper, Gold, Silver, and the various Metals, with engravings of New Apparatus, descriptions of New Alloys, and much other valuable information.

2.—MECHANICS AND ENGINEERING.—Embracing descriptions of New Mechanical Processes, Inventions, Public Works, Improvements in Steam Engines, Boilers, Motors, Railways, Canal Navigation, Naval Engineering, Mechanical Engineering, Civil Engineering, Building, New Mechanical Inventions, with many engravings.

3.—ELECTRICITY, LIGHT, HEAT, SOUND.—Embracing the latest Improvements in Telegraphy and Telegraph Engineering, Improvements in Galvanic Batteries, Electric Engines, New and Useful Applications of Electricity in the Arts—with engravings.

4.—TECHNOLOGY.—Embracing New and Useful Inventions and Discoveries relating to THE ARTS; Improvements in Photography, Printing, New Implements, New Machinery, New Processes, New Recipes, Improvements pertaining to Textile Industry, Weaving, Dyeing, Coloring, and the various branches of Industrial Labor, with accounts of New Industrial Products, Animal, Vegetable, and Mineral—with engravings.

5.—BOTANY AND HORTICULTURE.—Descriptions of New Plants, Trees, Shrubs and Flowers, introduced during the preceding year, with New, Useful and Interesting Facts in relation to Cultivation, Propagation, etc.—with engravings.

6.—AGRICULTURE.—New and Useful Information in the branches of Agriculture, with Notices of New Processes, New Implements, New Plants, Products etc. Improved modes of Treating Soils, Preparing Manures, Information concerning Domestic Animals, their Diseases, Treatment, etc.—with engravings.

7.—RURAL AND HOUSEHOLD ECONOMY.—The Latest Information concerning Building Materials, Improvements thereon, Improvements in Houses, Furniture, Lighting, Heating, Ventilation, Laundry Processes and Apparatus, Valuable information relating to Food, its Preparation, Preservation, etc., including New and Valuable Recipes, and a great variety of Miscellaneous Information pertaining to the Household—with engravings.

8.—MATERIA MEDICA, THERAPEUTICS, HYGIENE.—Exhibiting the progress of Medical Science in various branches, New Medicinal Preparations, New Health Inventions and Appliances, with much Interesting Information.

9.—NATURAL HISTORY AND ZOOLOGY.—The latest discoveries in Microscopy, Implements and Appliances in Microscopic Investigation, Scientific Explorations, Physiology, Anatomy, Discoveries relating to Pre-historic Man, Interesting Information and Discoveries relating to Mammals, Birds, Reptiles, Fishes, and Insects—with engravings.

10 & 11.—METEOROLOGY, TERRESTRIAL PHYSICS, GEOGRAPHY.—Accounts of Interesting Atmospheric and Terrestrial Phenomena, Travels, Explorations and Discoveries, including descriptions of the Great National Park—with engravings.

12.—GEOLOGY AND MINERALOGY.—The Latest and most Interesting Geological Investigations and Reports, Accounts of New Minerals, New Mineral Discoveries, Fossils, and Remarkable Phenomena.

13.—ASTRONOMY.—Recent Interesting Discoveries and Information relating to the Planets, Comets, Meteorites, Aurora, the Sun, with Reports of Astronomical Phenomena, Progress, New Instruments, etc.

14 & 15.—BIOGRAPHY, NECROLOGY.—Biographies of distinguished Men of Science, with steel-plate and other Portraits. Notices of Prominent Men connected with Arts and Sciences, recently deceased. with Portraits.

Every person who desires to be well informed concerning the Progress of the Arts and Sciences should have a copy of SCIENCE RECORD FOR 1873. It will be a most interesting and valuable Book, and should have a place in every Household, in every Library.

650 pages, Octavo. Handsomely Bound. Many Engravings. Price, $2.

Sent by mail to all parts of the country, on receipt of the price. A liberal discount to the trade and to canvassers. For sale at all the principal Bookstores.

MUNN & CO., PUBLISHERS,
37 Park Row, New York City.

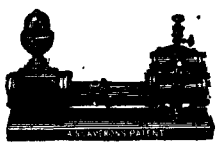
THE *SCIENTIFIC AMERICAN* will be sent one year and one copy of *SCIENCE RECORD FOR* 1873, on receipt of $4·50.

SCIENCE RECORD FOR **1872,** uniform with the above. Price $2.

EVERY VARIETY
STEAM PUMPS.
SEND FOR ILLUSTRATED CATALOGUE
COPE & MAXWELL MFG. CO.
HAMILTON, OHIO.

BUILDERS Send stamp for our new illustrated catalogue. A. J. BICKNELL & CO., 27 Warren St., N. Y.

A. S. CAMERON & CO.,

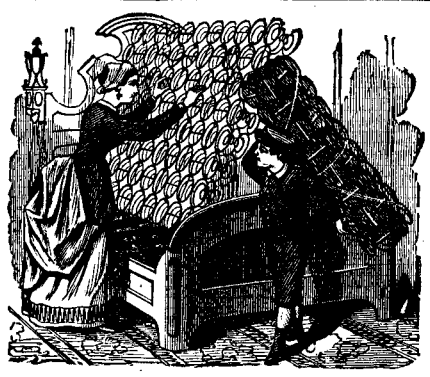


ENGINEERS,
Works, foot of East 23d street, New York City.

Steam Pumps,

Adapted to every possible duty.
Send for a Price List.

BEACH'S Scroll Sawing Machine, Improved guaranteed the cheapest and best in use. Thirty days' trial given. Send for illustrated circular and price list. Address H. L. BEACH, 90 Fulton St., New York.



CHAMPION SPRING MATTRESS—The latest and best improvement. Do you want a healthy and comfortable bed? Here it is. The softest, easiest, cheapest, most popular, and durable Spring Bed in market. Sold by all leading dealers. No stock complete without it. Wholly composed of tenacious tempered steel springs, so united that the pressure is equally distributed. Easily moved or carried about the house. Can be lifted, turned, or rolled up like a blanket. Both sides alike. No frame, no wooden slats. May be used on floor without bedstead. No under bed required. Needs only half thickness of hair mattress. Warranted noiseless. Any sizes made to order. Send for pictorial circular. Retail price of double bed, $12. Shipped, by single bed or quantity, to all parts of the world. Liberal discount to the trade. F. C. BEACH & CO., Makers, 131 and 133 Duane Street, New York.

Damper Reg. Pat. Gage Cocks. Water Feed Reg's.

Send for Circulars. MURRILL & KEIZER, Balt., Md

PATENT
COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS PAT. COUPLING, and furnish Pulleys, Hangers, etc., of the most approved styles. Price lists mailed on application to
JONES & LAUGHLINS,
Try street, 2d and 3d avenues, Pittsburgh, Pa.
190 S. Canal st., Chicago.

☞ Stocks of this Shafting in store and for sale by FULLER, DANA & FITZ, Boston, Mass.
GEO. PLACE & CO., 126 Chambers street, N. Y.
PIERCE & WHALING, Milwaukee, Wis.

SAWS
EMERSONS IMPROVED PATENT INSERTED TOOTHED SAWS
CHEAPEST SAWS EVER USED
EVERY SAW WARRANTED TO GIVE PERFECT SATISFACTION
SEND FOR CIRCULAR AND PRICE LIST
EMERSON FORD & CO. BEAVER FALLS PA

EXTRA STRAIGHT "Franconia Shafting Iron"—For line or machine shafting. Delivered in Boston, New Haven, or New York.
WILLIAM E. COFFIN & CO.,
Boston, Mass.

KIDDER'S PASTILES—A Sure Relief for Asthma. STOWELL & CO. Charlestown, Mass.

INTERNATIONAL EXPOSITION AT VIENNA, 1873.

Those who desire to send articles to the above named Exposition are respectfully informed that the undersigned procures permit certificates, good until December 31st, 1873, and that he is enabled to give all requisite information. Applications should be made without delay.
WM. LORENZ,
Attorney at Law for Germany, Austria, &c.
Office, 305 Coates St., Philadelphia, Pa.

"PUNCHING AND SHEARING" MACHINERY,

POWER AND HAND,
ALWAYS READY FOR USE, EITHER AS A PUNCH OR SHEAR, WITHOUT CHANGE.

Will furnish a machine that will cut 1x8—2 in. round or square, and punch 2 inch hole in inch iron, for $1400; and one that cuts 14x¼, 4x½, and 1¼ inch round, punch one inch hole in half inch iron, for $450.

A large variety of Punching and Shearing Machinery always on hand.

Address, for catalogue and prices,
DOTY MANUFACTURING COMPANY,
Janesville, Wis.

THE
BURLEIGH ROCK DRILLS
AND
BURLEIGH AIR COMPRESSORS

Are the only Drilling Machinery that has ever done any successful Tunnel work in America. (They are to be used on the St. Gothard Tunnel, Switzerland, Tunnel 13 miles long.) We refer to the following Gentlemen and Works:

Genl. Newton, U. S. A.....Hell Gate Tunnel, L. I.
Mess. Shanley.....Hoosac Tunnel, Mass.
J. Dutton Steele.....Nesquehoning Tunnel, Pa.
Sidney Dillon.....Fourth Avenue Work, N. Y.
Col. Roebling.....East River Bridge Company, N. Y.

For further information, &c., address
BURLEIGH ROCK DRILL COMPANY,
Fitchburg, Mass.

AGENT WANTED—In each city in which are water-works,—to sell Bennett's Self-acting, constant, equable-pressure Force-pump, for drawing Ale, Beer, &c. Apply to JOHN F. BENNETT, 108 Smithfield Street, Pittsburgh, Pa.

"The Harrison Boiler."

Seven years' service in some of the largest establishments in New England and elsewhere, with boilers varying from One Hundred to Fifteen Hundred Horse Power, with repeated orders from the same parties, shows that this improved generator has taken a permanent place in the use of steam.

Fifty Thousand Horse Power, have been made and put in use with a present steady demand.

When the destructible portions of this boiler are worn out, its generating surface can be made entirely new, for one half the cost of original.

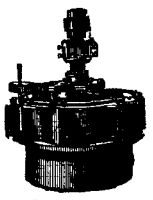
For all information, circulars, etc., application must be made direct to the
HARRISON BOILER WORKS,
Grays Ferry Road,
Philadelphia, Pa

MAHOGANY,

ROSEWOOD, FRENCH WALNUT, SATIN WOOD, HUNGARIAN ASH, CEDAR, ETC.
Large and Choice Stock Foreign and Domestic Woods, in
VENEERS, BOARDS, AND PLANK.
Imported and Manufactured by
GEORGE W. READ & CO.,
Office, Mill and Yard, 186 to 200 Lewis St., cor. 6th, E. R.
Branch Salesroom—**170 & 172 Centre St., N. Y.**
Orders by mail promptly and faithfully executed.
☞ Send for Catalogue and Price List.

MCNAB & HARLIN
Manufacturing Co., Manufacturers of
BRASS COCKS
FOR STEAM, WATER AND GAS.
WROUGHT IRON PIPE AND FITTINGS.
Illustrated Catalogue and Price-list furnished on application. 56 *JOHN STREET NEW YORK.*

IRON PLANERS, ENGINE LATHES, Drills, and other Machinists' Tools, of superior quality, on hand, and finishing. For sale low. For Description and Price address NEW HAVEN MANUFACTURING CO., New Haven, Conn.



THE
AMERICAN
Turbine Water Wheel

Has recently been subjected to thorough tests by James Emerson, Holyoke, Mass., showing higher average results than any Turbine Wheel ever known. A full report may be obtained of STOUT, MILES & TEMPLE, Dayton, Ohio.

Agents Wanted $75 to $250 per month, everywhere male and female, to introduce the GENUINE IMPROVED COMMON SENSE FAMILY SEWING MACHINE. This Machine will stitch, hem, fell, tuck, quilt, cord, bind, braid and embroider in a most superior manner. Price only $15. Fully licensed and warranted for five years. We will pay 1,000 for any machine that will sew a stronger, more beautiful, or more elastic seam than ours. It makes the "Elastic Lock Stitch." Every second stitch can be cut, and still the cloth cannot be pulled apart without tearing it. We pay Agents from $75 to $250 per month and expenses, or a commission from which twice that amount can be made. Address SECOMB & CO., Boston, Mass.; Pittsburgh, Pa. Chicago, Ill. or St. Louis, Mo.

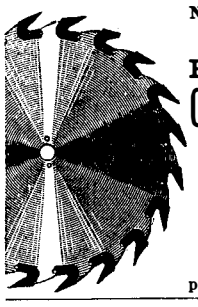
TRADE MARK

Union Stone Co.,

Patentees and Manufacturers of
Emery Wheels & Emery Blocks
In size and Form to Suit various Mechanical Uses;
GRINDERS, SAW GUMMERS, DIAMOND TOOLS, and WOOD'S PATENT KNIFE GRINDER,
For Planing, Paper Cutting, Leather Splitting, and al other Long Knives.
OFFICE, 16 EXCHANGE STREET, Boston, Mass.
BRANCH OFFICES { W. S. Jarboe, 98 Liberty Street, N. Y. / 502 Commerce Street, Philadelphia, Pa.
☞ Send for circular.

SCHLENKER'S PATENT
BOLT CUTTER
NEW INVENTION. ADDRESS.
HOWARD IRON WORKS BUFFALO N.Y.

American Saw Co.



No. 1 Ferry Street, corner Gold Street, New York.
MANUFACTURERS OF
Patent Movable Toothed
CIRCULAR SAWS,
Patent Perforated
Circular, Mill,
AND
Cross-cut Saws.

☞ Send for Descriptive Pamphlet.

ISAAC S. CASSIN, Engineer, late Chief Engineer of the Philadelphia Water Works, No. 431 Race St., Philadelphia, Pa. Water Works constructed, Surveys and Estimates made, Drawings and Specifications, and all kinds of Hydraulic Machinery and materials furnished.

Working Models

And Experimental Machinery, Metal, or Wood, made to order by J. F. WERNER, 62 Center st., N. Y.

EMERY

Grinders, Pat'd 1869.
Unequaled for the sterling quality of their materials and workmanship, the durability of every part. Any desired make of solid Wheels furnished, carefully fitted to the machine, turned perfectly true, and started at the maker's guaranteed speed. Grinders for all purposes, ready for immediate use, that can be run with perfect safety. Address
AMERICAN TWIST DRILL CO., Woonsocket, R. I.

Over 15,000,000 square feet in use.

H. W. JOHNS'

ASBESTOS ROOFING

For steep or flat Roofs, in all climates,
ASBESTOS ROOF COATING.
For restoring old Tin, Felt, and Shingle Roofs,
ASBESTOS BOILER FELTING.

The best non-conductor, and the lightest and most economical covering for Steam Pipes, Boilers, Oil Stills, etc., whether housed or exposed to the weather.

These materials are prepared ready for use, and can be easily applied by any one.

ROOFING AND SHEATHING FELTS, ASBESTOS BOARD, ASBESTOS PAPER, ASBESTOS, ASPHALTUM, &c.

Send for Descriptive Pamphlets, Price Lists, Terms to Dealers, etc.

H. W. JOHNS,
{ *Established in* 1858. } New Offices, 87 MAIDEN LANE, cor. GOLD STREET, New York.

☞ T. V. Carpenter, Advertising Agent. Address Box 778, New York city.

PETER COOPER'S
Refined Neats' Foot Oil,
FOR FIRST CLASS MACHINERY.

It contains no gum or acid, and is warranted pure and equal to the best Sperm Oil.
☞ For sale at No. 17 Burling Slip, New York.

The Tanite Co.,

Inventors and Builders of Special Machinery connected with Emery Grinding.

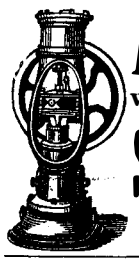
Solid Emery Wheels, from ½ inch to 2 feet in diameter Emery Grinding Machines at $15, $30, $50, $75, and $110 Stove Rests, $5. Diamond Tools, $15. Special Tools and Machines made to order. SEND FOR ILLUSTRATED CATALOGUES AND PHOTOGRAPHS!

By means of extensive additions to their factory and Machinery, THE TANITE CO. are now (September, 1872) enabled to triple their former production, and to supply promptly their increasing demand for their celebrated and STANDARD MAKE OF GOODS. All Goods sold by THE TANITE CO. *are made by them at their own Factory, under their own Patents and Processes.*

Address **THE TANITE CO.,**
Stroudsburg, Monroe Co., Pa.

Diamond Pointed STEAM DRILLS.

THE adoption of new and improved applications to the celebrated Leschot's patent, have made these drills more fully adaptable to every variety of ROCK DRILLING. Their unequalled efficiency and economy are acknowledged, both in this country and Europe. The Drills are built of various sizes and patterns; WITH AND WITHOUT BOILERS, and bore at a uniform rate, of THREE TO FIVE INCHES PER MINUTE in hard rock. They are adapted to CHANNELLING GADDING, SHAFTING, TUNNELLING, and open cut work; also, to DEEP BORING FOR TESTING THE VALUE OF MINES AND QUARRIES. TEST CORE taken out, showing the character of mines at any depth. Used either with steam or compressed air. Simple and durable in construction. Never need sharpening. Manufactured by
THE AMERICAN DIAMOND DRILL CO.,
No. 61 Liberty St., New York



Always Reliable.

Wright's Double-Acting Bucket-Plunger.
STEAM PUMPS.

Made by the Valley Machine Co.
EASTHAMPTON, Mass.

Machinist's Tools,

EXTRA HEAVY AND IMPROVED.
LUCIUS W. POND, MANUFACTURER
Worcester, Mass.
Warerooms, 98 Liberty Street, New York.
A. C. STEBBINS, Agent.

RANSOM SYPHON CONDENSER perfects and maintains vacuum on Steam Engines at cost of one per cent its value, and by its use Vacuum Pans are run with full vacuum without Air Pump. Send to WM. ALLEN, 51 Chardon St., Boston, for a personal call, or he Company, at Buffalo, N. Y., for a circular.

WIRE ROPE.

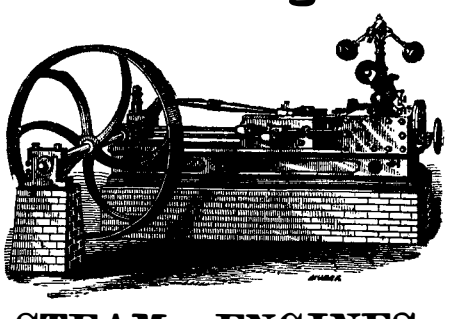
JOHN A. ROEBLING'S SONS.
MANUFACTURERS, TRENTON, N. J.

FOR Inclined Planes, Standing Ship Rigging, Bridges, Ferries, Stays, or Guys on Derricks & Cranes, Tiller Ropes, Sash Cords of Copper and Iron, Lightning Conductors of Copper. Special attention given to hoisting rope of all kinds for Mines and Elevators. Apply for circular, giving price and other information. Send for pamphlet on Transmission of Power by Wire Ropes. A large stock constantly on hand at New York Warehouse, No. 117 Liberty street.

MORRIS, TASKER & CO.,
MANUFACTURERS OF
AMERICAN CHARCOAL IRON
Boiler Tubes.
WROUGHT-IRON TUBES AND FITTINGS, FOR GAS, STEAM, WATER, AND OIL.

☞ Steam and Gas Fitters' Supplies, Machinery for oal Gas Works, &c., &c.
NO. 15 GOLD ST., NEW YORK.

Utica Steam Engine Co.



STEAM ENGINES,

PORTABLE & STATIONARY.

"THE BEST, CHEAPEST, MOST DURABLE."
Improved Circular Saw Mills, Screw and Lever Set. ☞ Send for Circular.
UTICA STEAM ENGINE CO., Utica, N. Y.
G. G. YOUNG, GENERAL AGENT,
42 Cortlandt St., New York.

E. T. SWEZEY,
WHOLESALE DEALER IN METALS,
6 New Bowery & 398 Pearl St., N. Y.
Copper, Brass, Lead, Spelter, Tin, Composition, Antimony, Anti-Friction Metal, etc. etc.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard sts., Philadelphia and 59 Gold st., New York.

© 1873 SCIENTIFIC AMERICAN, INC.